ARCHIVES OF OTOLARYNGOLOGY

VOLUME 1 JUNE, 1925 NUMBER 6

STENOSIS OF THE LARYNX IN LARYNGEAL TUBERCULOSIS

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ETIOLOGY

While stenosis is not a frequent complication of laryngeal tuberculosis, it is still sufficiently common to merit careful consideration of the methods of relief by those who treat this disease. It is not the purpose in this paper to deal with those acute cases due to edema, but to discuss the more chronic forms of obstruction, caused by: (1) tuberculoma; (2) widespread and extensive infiltration; (3) paralysis of the abductors and ankylosis of the crico-arytenoid joint; (4) web formation; (5) amyloid disease.

Several instances of blocking from large tuberculomas are found in the literature. Jaehne [1] reports a typical case, the tuberculoma springing from the right ventricle of Morgagni and extending across to the opposite side, almost completely obstructing the glottic orifice (Fig. 1). The only symptom was hoarseness and, strangely enough, the respiration was not labored or quickened. Removal was followed by a spreading of the local tuberculous process and a lighting up of the lung lesion. Douglass [2] observed a large tuberculoma entirely closing the rima glottis; no opening into the larynx could be discovered.

Fetterolf's [3] case, in which the vocal cords were united at their anterior halves, leaving a small round glottic opening, is similar to Case 3 of my series. Von Lénárt [4] also saw a case in which the adhesions followed three weeks after surgical removal of tuberculous granulations. The patient was treated by laryngofissure and excision and the application of a Thiersch graft.

The cases of stenosis due to extensive infiltration are frequently associated with fixation of the arytenoid or with posticus paralysis. The

1. Jaehne, A.: Ein Fall von Tuberculom des Larynx, Ztschr. f. Ohrenh. **66**:8, 1912.
2. Douglass, Beaman: An Unusual Case of Tuberculosis of the Larynx, Laryngoscope **32**:236 (March) 1922.
3. Fetterolf, George: The Larynx in Pulmonary Tuberculosis, Laryngoscope **26**:37 (Jan.) 1916.
4. Von Lénárt, Z.: Mittelst Laryngofission und Transplantation geheilter Fall von Larynxstenose, Ztschr. f. Ohrenh. **68**:277, 1913.

last two conditions may be combined. Following perichondritis, one arytenoid becomes fixed in the midline; later, abductor paralysis develops one the opposite side, there is less and less outward movement of the cord on inspiration, increasing dyspnea and, eventually, suffocative attacks supervene. Death by suffocation is inevitable unless the obstruction is removed by tracheotomy. A confrère saw such a condition one afternoon and advised immediate tracheotomy, but the patient elected to wait until the next day and was found dead in bed the following morning. Pressure on the recurrent laryngeal nerve by enlarged lymph nodes lying along the trachea may cause paralysis and, according to Schmidt,[5] both sides may be affected simultaneously.

Web formations, following healing of the tuberculous lesions, are interesting because of their rarity, although they are not uncommon after syphilitic ulcerations in the larynx. They represent an end-result in the process of healing, analogous to fibrosis of the lung in long standing

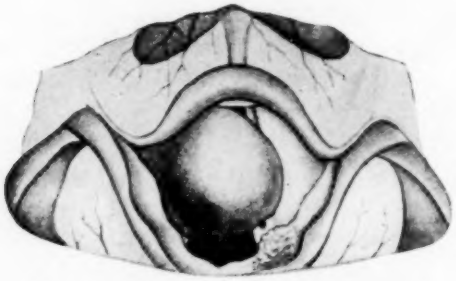

Fig. 1.—Jaehne's case of tuberculoma.

pulmonary tuberculosis. I have seen this condition in two patients, in both of whom the scar lay above the cords and had its origin in the ventricular bands.

Amyloid tumor of the larynx is a very rare disease. Pugnat [6] saw a case of this condition in 1918, which he says is the twenty-eighth reported. He says the condition occurs in middle age and in old age, usually in men, most often in the conjunctiva and next in frequency in the larynx. He describes the tumor as being of a "vitreous translucent appearance." Swershewski [7] and Willimann [8] each report one case. The diagnosis in both was confirmed by histologic examination; one was

5. Schmidt, M.: Die Krankheiten der obere Luftwege, Ed. 3, Berlin, 1903, p. 392.

6. Pugnat, A.: J. de Laryngol. Abstr. J. Laryngol., Rhinol. & Otol. **34**:32 (Jan.) 1919.

7. Swershewski, L.: Lokales Amyloid des Kehlkopfes, Russk, Monatschr. f. Ohrenh. (April) 1910; abstr. Ztschr. f. Ohrenh. **62**:274, 1911.

8. Willimann, H.: Ein weiterer Fall von Amyloidtumor des Larynx, Arch. f. Laryngol. **26**; abstr. Ztschr. f. Ohrenh. **68**:249, 1913.

cured by roentgen rays and the other by removal. These amyloid tumors must be pathologically different from the condition of so-called amyloid disease. The latter accompanies prolonged suppuration, tuberculous empyema, bone tuberculosis and other wasting diseases, and affects the liver, spleen, kidneys and intestines. It is invariably and rapidly fatal. The former is usually described as a benign tumor, lasting for years, and is apparently not a part of a generalized degeneration.[9] In one of my patients who died of general amyloid disease, the stenosis was apparently due to a fibrous web but, as no microscopic examination was made, amyloid degeneration locally was not confirmed.

TREATMENT

Surgical relief of some sort is required in all patients when the respiration becomes difficult; hence it is important not to delay the tracheotomy too long. One should not wait until these patients have become exhausted by their efforts to breathe or until they suffer from oxygen starvation. Besides promoting the general well-being of the patient and improving the tuberculosis of the lung, early tracheotomy has a particularly favorable influence on the tuberculous disease of the larynx. Schmidt[10] recommends tracheotomy as a therapeutic measure in laryngeal tuberculosis, even in the absence of stenosis. It is not uncommon to see an early and a comparatively rapid improvement locally. If the stenosis be due solely to the infiltrative process, the tube may be removed as soon as this disappears, which often happens within a few months.

Laryngectomy, as advocated by Onodi,[11] seems to be an unnecessarily severe remedy.

Paralytic patients frequently require hurried tracheotomy because of their tendency to refuse early operation.

In cases complicated by web formation and paralysis or ankylosis, even though the infiltration may have disappeared, glottic respiration is, naturally, still impossible. It is desirable to decannulize these patients as soon as possible, but due regard must be given to the danger of setting up renewed activity of the tuberculous process. One should wait several months or a year, until this has become thoroughly quiescent; then, as soon as it is safe to do so, the hindrance to respiration should be removed.

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9. Wright, J., and Smith, H.: Diseases of the Nose and Throat, Philadelphia, Lea & Febiger, 1914, p. 496.

10. Schmidt, M.: Die Krankheiten der obere Luftwege, Ed. 3, Berlin, 1903, p. 426.

11. Onodi, A.: Totale Kehlkopfextirpation bei Kehlkopftuberculose, Ztschr. f. Ohrenh. **70**:9, 1914. This operation was done by Gluck, who had performed the same operation on thirty-four, with healing in 11 patients. In the case reported "healing was complete" but the patient died two months later with acute lung inflammation.

It is difficult to secure a good result because of the tendency of the scar to return. Sometimes incision and forcible intubation may succeed. Delavan,[12] Rogers [13] and Imperatori [14] report success with this method although they were not dealing with tuberculosis. In one of my patients it was temporarily beneficial. Most patients will need laryngofissure and removal of the obstruction, followed by prolonged dilation. Dilation by doubled rubber tubing has been advocated by Oglauer [15] and Schmieglow, and recently a careful method of treatment by dilation has been worked out in Dr. Chevalier Jackson's clinic.[16] Moore [17] suggests an ingenious operation for transplanting the anterior ends of the cords laterally in patients with abductor paralysis. The sequelae of the tuberculous lesion might defeat the aim of this operation in the cases under discussion.

If the tube is worn for too long a time, these patients seem to lose the knack of normal respiration and it is difficult to dispense with it. Another disadvantage is the development of tracheal spurs at the end of the tube which interfere with the airway. One of my patients, when seen four years after the tracheotomy, was still wearing the tube. A patient of Dr. Mullin still wears the tube at night, ten years after its introduction. The lesion in his case was very advanced but has now been healed for many years.

CASE REPORTS

CASE 1.—W., a woman, aged 25, was first seen in June, 1908. She presented a history of pulmonary tuberculosis for a year and hoarseness for seven months, with no laryngeal pain.

Examination revealed tuberculous infiltration of both arytenoids, posterior wall and both vocal bands, with reddening of the right vocal band (Fig. 2).

Under local treatment the infiltration diminished and the voice became clear. The throat lesion remained quiescent until May, 1911, a period of fifteen months, when there was renewed activity, indicated by infiltration and ulceration, involving the right ventricular and vocal bands and increased infiltration of both arytenoids (Fig. 3).

The condition slowly grew worse and five months later suffocative attacks occurred at intervals, due to narrowing of the glottis from paralysis or ankylosis. After two months more, the stenosis was so great that a tracheotomy became necessary. The cords lay close together and there was no movement on inspiration (Fig. 4).

Meanwhile the tuberculosis of the lung had become active and the throat was very painful. The embarrassed respiration was, of course, immediately

12. Delavan, D. Bryson: Treatment of Cicatricial Stenosis of the Larynx, J. Laryngol., Rhinol. & Otol. **24**:42 (Nov.) 1909.

13. Rogers, John: Articles in Am. J. M. Sc., November, 1905, and April, 1908.

14. Imperatori, C. J.: Chronic Stenosis of the Larynx, Laryngoscope **27**:172 (March) 1917.

15. Iglauer, S.: Treatment of Laryngeal Stenosis, Ann. Otol., Rhinol. & Laryngol. **27**:1233 (Dec.) 1918.

16. Tucker, Gabriel: Laryngostomy for Laryngeal Stenosis, Arch. Otolaryngol. **1**:157 (Feb.) 1925.

17. Moore, Irwin: Operative Procedures in the Treatment of Stenosis of the Larynx Caused by Bilateral Paralysis of the Abductor Muscles, J. Laryngol. & Otol. **38**:236 (May) 1923.

relieved after the tracheotomy. Unfortunately, the tissues around the wound became infected with tuberculosis, resulting in extensive undermining and ulceration. After nine months of misery, death finally brought relief, four and a half years after the first examination.

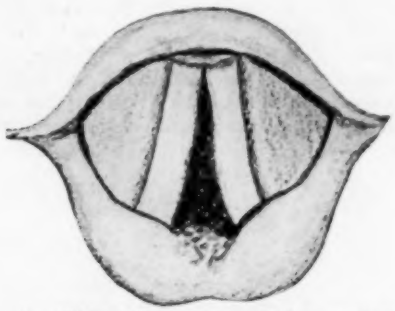

Fig. 2 (Case 1).—Illustrating the condition at first examination.

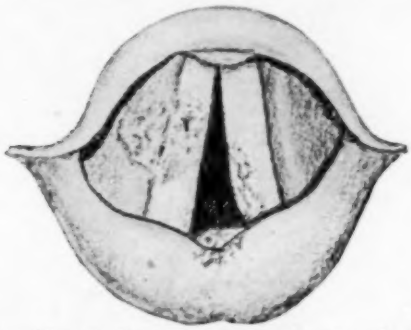

Fig. 3 (Case 1).—Almost three years later; note ulceration on right ventricular and vocal bands; increased infiltration.

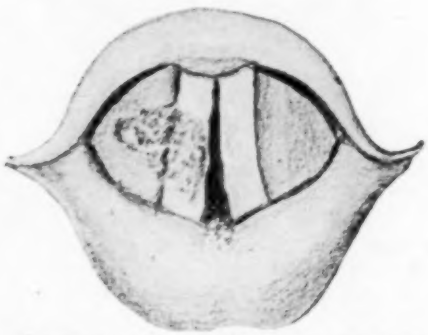

Fig. 4 (Case 1).—Larynx at time tracheotomy was done. Note position of cords.

CASE 2.—A. H., a man, aged 23, who consulted me, May 10, 1908, had had pulmonary tuberculosis for three years. Since an attack of "grip," five months prior to examination, the patient had been failing; he had aphonia during the past winter and had been hoarse for the last two months; there was no pain. For three nights he had not been able to sleep on account of difficult breathing.

Examination of the larynx showed infiltration of the epiglottis, aryepiglottic folds, arytenoids and ventricular bands. The left cord was fixed in the position of phonation; outward motion of the right cord was limited. Stridor and dyspnea were present (Fig. 5).

Immediate tracheotomy was urged but was refused. During the next month there were repeated attacks of suffocation, the last one so severe that he almost died. When seen the next morning, the cords were in complete adduction with practically no movement of the right one, which had gradually lost the power of abduction during the preceding month. The patient now consented to tracheotomy, which was performed immediately. Three months after the operation, the lesion in the larynx was almost entirely healed, but the

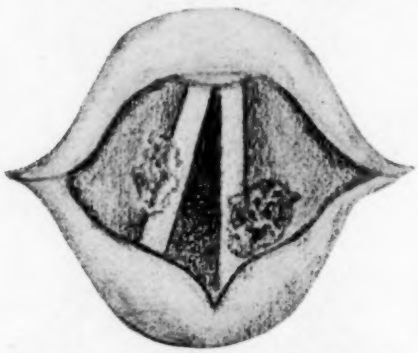

Fig. 5 (Case 2).—First examination. Note fixation of left cord.

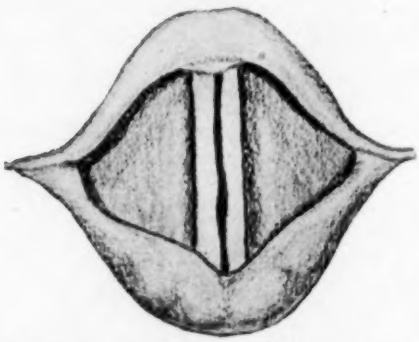

Fig. 6 (Case 2).—Four and a half years later. Almost complete stenosis; both cords in the median line. Ulcers healed.

cords were still in adduction. One year later there was complete healing of the tuberculous process in the larynx, and the lung lesion was quiescent. The patient disappeared from view for three and a half years, at the end of which time has was again examined. There was no change in the position of the cords; he was not able to breathe through the larynx and still wore the tube, four and a half years after its introduction (Fig. 6).

Comment.—In my opinion, these two cases represent instances of ankylosis and paralysis combined. If the first patient had been more assiduous in following advice, it is probable that the original laryngitis would have remained healed. Both patients had attacks of suffocation

at night, which are always dangerous and are likely to prove suddenly fatal. The second case is a good example of the curative effect of rest to the larynx and of increased oxygenation afforded by tracheotomy.

CASE 3.—E. M., a girl, aged 17 years, was first seen April 2, 1909, complaining of pain in the throat and of hoarseness. She had extensive, active pulmonary tuberculosis. The throat symptoms had existed for two months.

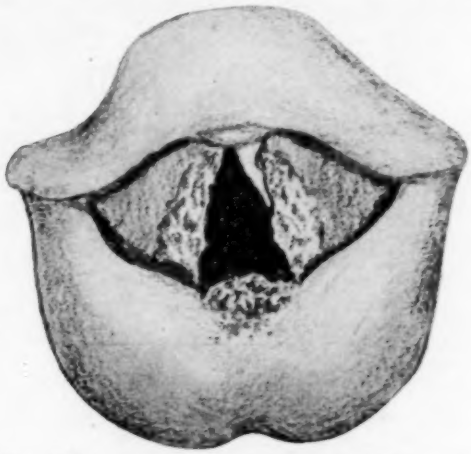

Fig. 7 (Case 3).—First examination. Note the wide-spread involvement.

Fig. 8 (Case 3).—Nine months later. Cords adherent to each other.

Examination.—Extensive tuberculous infiltration and ulceration involving the epiglottis, both ventricular bands, aryepiglottic folds, arytenoids, posterior commissure and vocal bands were seen (Fig. 7).

In five months, under general and local treatment, the ulcerations healed. However, four months afterward a narrowing of the glottis from scar tissue developed, and the movements of the arytenoids were hindered by ankylosis. The anterior halves of the cords were apparently adherent to each other, leaving only a small space posteriorly for respiration (Fig. 8).

Two months later, owing to increasing dyspnea, measures for relief were imperative. The available space for respiration consisted of a round opening through a web-like scar, which extended from the epiglottis backward, embracing the ventricular bands and blending with the infiltrated arytenoids. Through this opening the immovable cords could be seen, fixed in a position between phonation and inspiration (Fig. 9).

The opening in the web was enlarged with biting forceps and an O'Dwyer tube was inserted, which gave relief to the embarrassed respiration. Quantities of viscid sputum were brought up through the tube, causing some difficulty in keeping it free. After some preliminary improvement, the tuberculosis of the

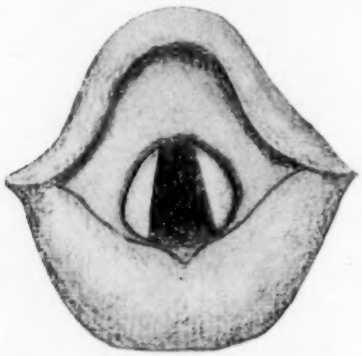

Fig. 9 (Case 3).—Stenosis from web at time of operation and intubation.

lung became more active and the patient failed rapidly. Amyloid degeneration of kidneys, liver and intestines was discovered, which ended fatally, ten weeks after intubation.

Comment.—This case is interesting because of the widespread involvement of the larynx; the remarkable improvement during the first eight months under active treatment, which included the inoculation of live tubercle bacilli by the patient's physician; the rapid development of scar tissue following the initial healing of the ulcerations, and the final development of amyloid disease. In order to relieve the dyspnea, portions of the obstruction were removed on one or two occasions before the use of the intubation tube, but with only temporary benefit. It is probable that these measures made matters worse; it would have been better to resort to tracheotomy at once and then to wait for the arrest of the tuberculosis before attempting removal of the laryngeal obstruction. Schmidt says,[18] "Stenosis in consequence of healed tuberculous ulceration should be left alone if there is no pressing need for relief, because of the danger of setting up renewed ulceration. One should wait at least a year."

Case 4.—E. P., a woman, aged 25, consulted me, March 24, 1915. She had had pulmonary tuberculosis for several months, during which time she had had "trouble" with her throat, which had become worse during the four weeks before consultation. She had pain occasionally, was hoarse, and strangled when drinking.

18. Schmidt, M.: Footnote 10, p. 605.

Examination.—A small ulceration on the right edge of the epiglottis, ulceration on the posterior ends of both cords extending across the posterior commissure and infiltration of the arytenoids (which was worse on the right side) were seen (Fig. 10).

This patient was treated for a year with galvanocautery and trichloracetic acid, with some improvement, namely, healing of the ulcer on the epiglottis and diminution of the infiltration of the arytenoids (Fig. 11). A recrudescence occurred six months later, with edema of the arytenoids and infiltration of the right ventricular band. This gradually improved and six months after-

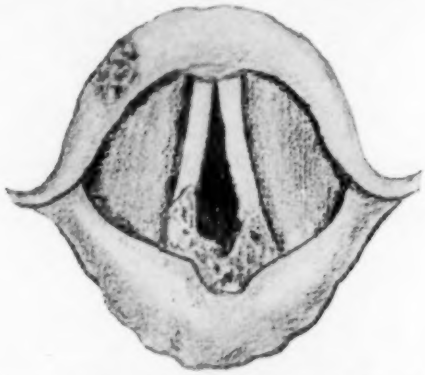

Fig. 10 (Case 4).—First examination showing ulceration on epiglottis, both cords and posterior wall.

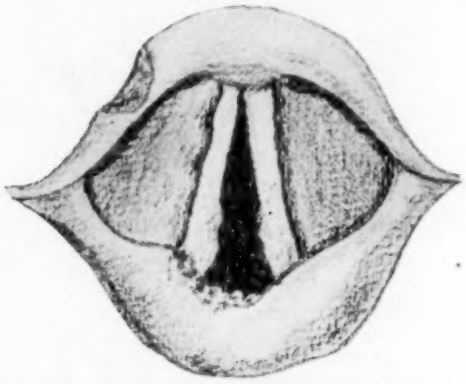

Fig. 11 (Case 4).—Ulcer on epiglottis healed; infiltration lessened.

ward the findings were: The epiglottis was distorted by scar and loss of tissue; the arytenoids were almost normal in appearance; the ulcers on both vocal bands and posterior wall had healed, and the right ventricular band was moderately infiltrated (Fig. 12). Five months after this observation, the patient visited her home, and renewed activity in the larynx occurred, indicated by infiltration of the right ventricular band and the arytenoids (Fig. 13). During the following six months the throat improved greatly. The exigencies of war prevented me from seeing the patient for fifteen months, at which time the following findings were noted: All the ulcers had healed; a sickle-shaped scar extended from the right ventricular band to the arytenoid and posterior

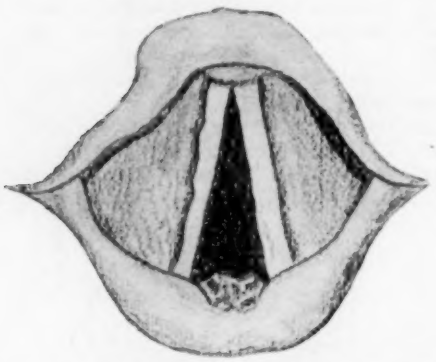

Fig. 12 (Case 4).—Ulcers healed; infiltration in posterior commissure.

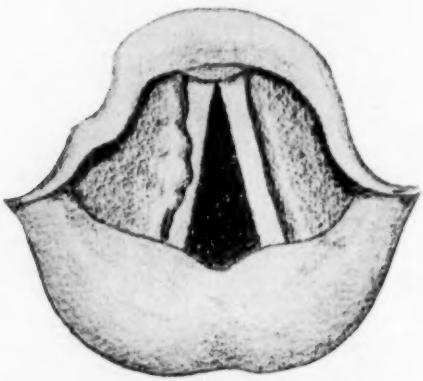

Fig. 13 (Case 4).—Renewed activity; infiltration of arytenoid region and right ventricular band.

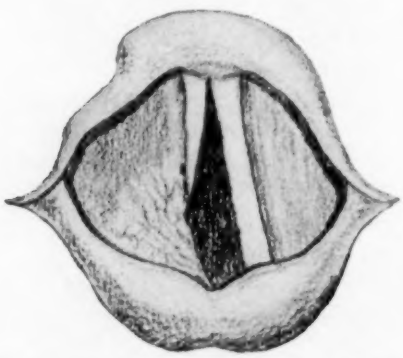

Fig. 14 (Case 4).—Respiration. Showing beginning of scar formation.

wall as far as the midline, and the arytenoids were slightly enlarged and pale (Figs. 14 and 15). The larynx remained quiescent for three years, at which time the patient complained of dyspnea on exertion, noisy respiration and poor

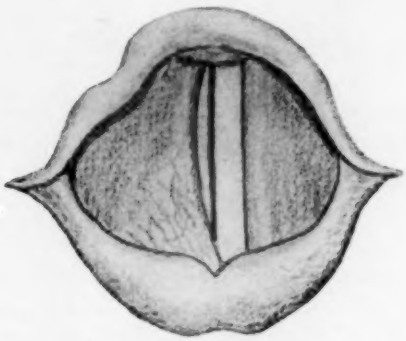

Fig. 15 (Case 4).—Phonation. Sketched at same time as Figure 14.

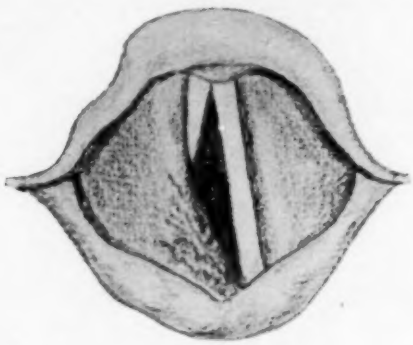

Fig. 16 (Case 4).—Compare with Figure 14; note extension of scar.

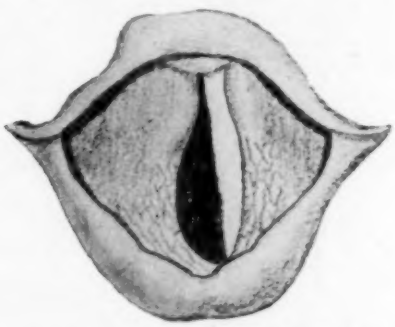

Fig. 17 (Case 4).—Condition on Feb. 23, 1925. Note retraction of scar on right and beginning scar formation on left.

voice. Her general condition was good. There was fixation of the left cord in a position midway between phonation and inspiration; the web had extended a little farther to the left, compromising the breathing space (Fig. 16). In May, 1924, diseased tonsils were removed on account of arthritis. Since then

the patient insists that her breathing is easier; she certainly has a better voice. No treatment for the relief of the stenosis has been instituted. The condition on Feb. 23, 1925, is illustrated in Figure 17. The left cord is still immovable; the shape of the scar seems somewhat altered by contraction.

Comment.—This case is an example of unremitting fighting against an insidious and implacable foe, extending over a period of ten years, during the first four of which the treatment was practically continuous. The net result is a person who is able to enjoy a fairly normal, if limited, existence, with a larynx which has healed—in fact, healed too well. Undoubtedly, this web is an end-process in the healing. The larynx is distorted and crippled in function by the scarring and the left cord is fixed, but fortunately not in the phonation position. But, in spite of all, the voice is clear although low in pitch. Whether this woman will have a lighting up of the focus in the larynx again, or whether the stenosis will become worse, time alone will show. I am inclined to believed not, because for three years there has been no relapse and these patients sometimes do develop, slowly and painfully through the years, a resistance to their infection which prevents a recrudescence. During these three years the dyspnea has been less, the stenosis has not increased and the pulmonary tuberculosis has remained completely arrested.

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THE USE OF IVORY IN RHINOPLASTY

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CINCINNATI

QUALIFICATIONS

A good nasal prosthesis must possess qualities assuring a satisfactory final result. Its substance should be easy to obtain, even in large quantities, nonirritant to the tissues which surround it, nonabsorbable and easy to model. Having previously discussed the use of different transplants in rhinoplasty,[1] I want here only to lay emphasis on the advantages of the ivory transplant, which result from its biochemical qualities. As we shall see, its morphologic and chemical structures justify *a priori* its use as an internal prosthesis, and clinical experience over a period of years seems definitely to establish its reputation.

AUTOPLASTY

That autoplasty is always the method of choice, writers at present are well agreed. Numerous researches and clinical observations published on both sides of the ocean prove this clearly.[2] But, from a practical point of view, the following questions ought to be answered first. Is autoplasty for nasal support always possible? Is it always advisable? Keeping strictly to the subject of rhinoplasty, we will have to answer these questions in the negative.

Objections From the Side of the Patient.—The principal source of autoplastic material for nasal reconstruction is cartilage furnished largely by the ribs. But resection of the rib cartilage is often refused by the patient, who is unwilling to submit to an additional surgical intervention confining him to bed for a long time, especially as a complete resection of the rib cartilage is often followed by pain similar to that of a rib fracture; the possibility of pain cannot be hidden from the patient, who has put his confidence regarding the consequences of the operation in his physician.

Possibility of Complications.—Pleural injury and formation of hematoma, although rare in a rib resection performed with good technic, nevertheless occur and, therefore, have to be taken into consideration.

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1. Maliniak, Jacques: Comparative Study of Ivory and Organic Transplants in Rhinoplasty. Endonasal Operative Technic of Some Nasal Deformities with Report of Cases, Laryngoscope **34** (Nov.) 1924.

2. Davis, T. S.: Transplantation of Rib Cartilage Into Pedunculated Skin Flaps, Bull. Johns Hopkins Hosp. **24**:116 (April) 1913.

Insufficiency of Rib Cartilage for a Single Large Graft.—On numerous occasions, when a single, large and straight graft is required, we have also to deplore the insufficiency of this cartilagenous source. A pronounced saddle nose deformity cannot be considered as completely corrected without the reconstruction of the lateral walls; but the tendency of the rib cartilage to bend, the natural curvature of this substance in the costal arch and its insufficient thickness limit its use for long, straight and large grafts.

The reconstruction of the nasal pyramid by multiple cartilagenous fragments, although possible, is more laborious and may compromise the end-result, as the fragments are rather difficult to maintain in place.

Syphilitic Nasal Deformity.—All the more is this the case in a typical syphilitic nose, in which there is a large loss of the nasal mucous membrane lining. In order to mask the syphilitic appearance of the nose, it is necessary, before placing the internal prosthesis, to free the retracted nasal mucous membrane from the underlying structure and to cover the denuded surface by an inlay of epidermis. A substitute for the missing nasal mucous membrane lining is thus provided.[3] In patients in whom the loss of the nasal mucous membrane is not very pronounced, an internal ivory prosthesis may, on account of its complete rebuilding and resistance, be used without the additional surgical procedure connected with an endonasal skin inlay (Case 2). Rib cartilage alone is insufficient for the correction of this specific deformity. This substance still is of great use for rebuilding medium sized nasal bridge defects.

Auricular and Alar Cartilages in Nasal Reconstruction.—The latter, as seen after septum operation or trauma and of congenital origin, can also be corrected with auricular cartilage removed through an incision behind the ear (Case 3). This minor procedure is more simple than a rib resection and excludes any possibility of complications. The scar placed at the insertion of the auricle remains concealed. In some circumstances associated with superabundancy of alar cartilages, the latter also may be used for the correction of a slight deformity of the bridge.

THE "TAKING" OF THE TRANSPLANT

The practical side in all free transplants is based on a possibility of the "taking" of the transplant in its new place and on its functional and organic persistence. The "taking" of the transplant occurs in one of the following ways:[4]

1. Conservation of the transplanted tissue (cartilage).

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3. Gillies, H. D.: Deformities of the Syphilitic Nose, Brit. M. J. (Nov. 24) 1923; ibid., Plastic Surgery of the Face, New York, Oxford Medical Press, 1923.

4. Lexer, Erich: Die Freien Transplantationen, Ed. 2, 1919.

2. Progressive absorption of the transplant and its replacement by its own tissue and that surrounding it (bone).

3. Transformation of the transplant into fibrous cicatricial tissue with the disappearance of its specific elements (fat).

4. The surrounding of the transplant by a capsule with permanency in relation to its size and shape (ivory).

INORGANIC SUBSTANCES IN RHINOPLASTY

Objections, perfectly justified, are raised against the use of inorganic internal prostheses. The majority of these foreign substances implanted in the tissues act as irritants and are finally absorbed or rejected with the appearance of suppuration.

Gold and Celluloid.—Nevertheless, some of the inorganic substances, such as gold or celluloid, have been used as implants with some success. The tolerance of human tissue for these two substances is sometimes remarkable. Thus Estor [5] presented before the Surgical Society of Paris 100 cases of cranioplasty showing good results with gold prosthesis. The publications of Fraenkel,[6] Föderl,[7] Lewis [8] and New [9] on celluloid implants claim good results with the use of this substance in surgery. Sebileau [10] and Blecker [11] have also observed, in isolated cases, a tolerance of the tissues for inorganic substances over a more or less prolonged time. And yet, celluloid, as we shall see later, by its chemical composition, is a substance foreign to the human body and for this reason acts an an irritant.

Heteroplasty: Ivory.—A priori, it has to be assumed logically, that ivory, which is an organic substance of a construction similar to human bone and practically not absorbable, as is shown by its resistance to absorption during many centuries,[12] would make an ideal internal prosthesis in rhinoplasty. It can be sterilized by boiling, is very easy to procure, and as art material is considered excellent for shaping. It has been employed in surgery by Gluck and Joseph in Germany, and by Mauclaire [13] in France. For many years I used this substance in rhinoplasty with excellent results and, for the first time, its use in nasal reconstruction has been described by me [1] in 1924.

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5. Estor, E.: Bull. et mém. Soc. de Chir. de Paris (Jan.) 1916.
6. Fraenkel, A.: Zentralbl. f. Chir. **47**:1072 (Aug. 28) 1920.
7. Föderl, O.: Wien. klin. Wchnschr., 1903.
8. Lewis, J. D.: Ann. Otol., Rhinol. & Laryngol. **32**:321 (June) 1923.
9. New, G. B.: The Use of Celluloid in the Correction of Nasal Deformities, J. A. M. A. **70**:989 (April 6) 1918.
10. Sebileau, P.: Bull. et mém. Soc. Chir. de Paris, 1917.
11. Blecker: Bull. et mém. Soc. de chir. de Paris (Jan.) 1916.
12. Banks, Edgar James: Bismaya or the Lost City of Adab, New York, 1912, p. 276 (cited by Kunz).
13. Mauclaire: Bull. et mém. Soc. Chir. de Paris (Jan.) 1916.

SOURCES OF IVORY AND ITS STRUCTURE

Definition.—In the limited sense of the word, by the term "ivory" we understand the substance obtained from elephant's tusks. But, in general, under this name are classified different varieties of dentin as well as the different vegetable ivories, which are substitutes for true ivory.

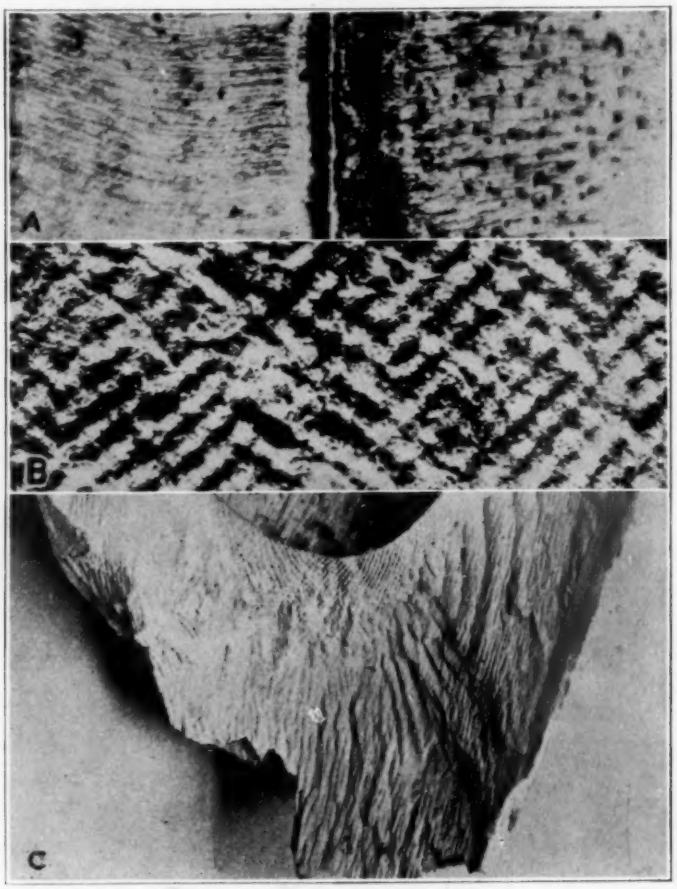

Fig. 1.—Structure of ivory; *a*, transverse section of an elephant's tusk, enlarged thirty times, showing the structure with bone canals appearing as small dark knots on the radiating lines; *b*, transverse section of a fossil form of ivory, enlarged about twelve times, showing more distinctly the pattern discernible in *a*, with erosion of the tusk; *c*, the interior hollow part of a tusk.

The latter point is of great practical importance, since only organic animal ivory, as we shall see later, approaches human bone in its structure (Table 1), hence it, being nonirritant to the tissues, should be used for nasal reconstruction.

Morphologic Structure.—A morphologic and chemical differentiation is therefore necessary. Morphologically, true ivory differs from other forms of dentin by the characteristic structure apparent on the transverse section. This consists of sinuous lines of different shades, the intersection of which form minute lozenge-shaped spaces disposed concentrically (Fig. 1).

Microscopic Examination.—A microscopic examination of ivory reveals a dense tubular structure. Across these tubes pass fine filaments of a protoplasmic substance, taking their origin in the central pulp of the tusk. These tubes are extremely fine; their maximum diameter is $\frac{1}{1000}$ inch (Fig. 1). The disposition and the peculiar curvature of the ivory tubes render the tissue expectionally elastic and tough.[14]

Pathology of the Tusk.—The elephant's tusk, the same as other living tissue, may be diseased and cause the animal to suffer excruciating pain. In such moments the elephant has sometimes broken off the tusk to escape the anguish. This can be explained by the fact that the pulp of the tusk is connected with the dentin by fine sensitive filaments passing through the dentin tubes.

Similar to bone, the tusk may show pathologic tumors. A complete collection of such specimens has been presented by Mr. Charles H. Wood to the Buffalo Society of Natural Sciences. Some of these diseased tusks show hollow spaces due to the attempts of the elephant to alleviate the acute pain caused by ulceration. These facts of pathologic histology prove that ivory, like bone, possesses a specific vitality as well as pathology.

Chemical Analysis of Ivory.—The comparative chemical analysis of ivory and bone, as given by M. Adolph Carnot,[15] may be summed up as shown in Table 1.

TABLE 1.—*The Comparative Chemical Analysis of Ivory and Bone*

	Human Bone Per Cent.	Ivory Per Cent.
Calcium phosphate ($Ca_3(PO_4)_2$)	87.45	82.08
Magnesium phosphate ($Mg_3(PO_4)_2$)	1.57	15.72
Calcium fluoride (CaF_2)	.35	.20
Calcium chlorid ($CaCl_2$)	.23	trace
Calcium carbonate ($CaCO_3$)	10.18	2.04
Ferrous Oxide (FeO)	.10	.08
	99.88	100.12

14. Kunz, G. F.: Ivory and the Elephant in Art, in Archeology and in Science, New York, Doubleday Page & Company, 1916.

15. Carnot, M. Adolph: Recherches du fluor dans les os Fossils, Compt. rend. Acad. d. Sc. **114**:1189.

This table shows a greater percentage of phosphate of magnesia and a smaller percentage of carbonate of lime in ivory than in human bone. Ivory contains about 43 per cent. of organic matter, while human dentin has only 25 per cent.

Fig. 2.—Sterile instruments and tools used for preparation of an ivory implant.

Because of its fine and close grained texture, its homogeneous character and adhesive hardness, its lack of brittleness and its good wearing qualities, ivory is an excellent substance to shape.

The quality of ivory, its "softness or hardness," has also to be taken into consideration.

Pseudo-Ivories.—However much the chemical composition of true ivory explains the perfect tolerance of the organism for this bony substance, the case is different with the pseudo ivories—imitations, which have only the exterior aspect of ivory. These imitations, known under the names of "French or Egyptian Ivory," should be avoided for implantation in the human tissues, since they are foreign bodies completely different in their composition from true ivory.

Vegetable Ivory.—Thus the tagua palm (Phytelephas macrocarpa), a very common tree in the forests of Ecuador, has nuts known under the name of "negritos." The kernels of these nuts resemble ivory very much, and have already become an important source of imitation ivory, the manufacture of which is quite extensive in the United States. Twenty thousand tons of these nuts are exported annually from Ecuador simply for the manufacture of ivory. The chemical composition of this vegetable ivory is shown in Table 2.

TABLE 2.—*Chemical Composition of Vegetable Ivory*

	Per Cent.
Gum	6.73
Legumin or vegetable casein	3.80
Vegetable albumin	.73
Ash	.61
Water	9.37
Lignin	81.34
	102.58

Another ivory imitation is obtained from rubber, after treatment with chloroform and zinc sulphate.

A composition called "galalith or milk-stone" has also been experimented with as an ivory substitute.

Chemical Test for Ivory Differentiation.—True ivory is differentiated from vegetable ivory in the following way: The substance to be examined is treated with concentrated sulphuric acid for fifteen minutes; true ivory remains white, while vegetable ivory becomes rose colored, but this coloration disappears on washing in water.

Celluloid Used as Pseudo-Ivory.—Celluloid is a substitute extensively used for ivory and this interests us the more because in these last years it has been recommended, as mentioned in the foregoing, for use in rhinoplasty. Celluloid may be considered as consisting more or less of nitrated pure cellulose and camphor, rendered plastic or dissolved in various solvents. After evaporation of the latter, it is obtained in the

form of solid blocks, plates or sheets. Bockman [16] gives the following analysis of celluloid (Table 3):

TABLE 3.—*Chemical Composition of Celluloid*

	Per Cent.
Nitro cellulose	73.70
Camphor	22.79
Coloring matter	3.51
	100.00

Bone, Ivory, Celluloid.—In comparing the chemical composition of bone, ivory and celluloid in the tables here given, we see that the structure of celluloid is completely different from that of our tissues, while ivory is very similar to bone.

Fig. 3 (Case 1).—Before and after ivory implantation.

PREPARATION OF AN IVORY IMPLANT

The ivory used for shaping the nasal prosthesis should be in blocks, pyramidal in form, corresponding in length and in size to the nose to be reconstructed. In general, three different sizes of these blocks should be at hand. Before being used, ivory should be put to the chemical test mentioned, to ascertain whether or not we are dealing with true ivory.

As the details of the technic have been already described,[1] I shall not consider them further here (Fig. 2). The ivory implant has to be perforated for the passage of fibrous tissue to immobilize the plate firmly. The latter is introduced through the incision in the eyebrow, by which method contact of the transplant with the skin sutures is avoided, and the result is an almost invisible scar.

16. Bockman, F.: Celluloid: Its Raw Material, Manufacture, Properties and Uses, Ed. 2, London, Scott Greenwood Co., 1921.

In total rhinoplasty, the dorsum and the lateral walls of the nasal pyramid have to be formed from a single piece of ivory. The nasal tip can be supported by a narrow strip of ivory or cartilage which is inserted into the philtrum through a vertical incision. It has its point of support on the anterior nasal spine behind and on the lower end of the dorsal prosthesis in front. In a saddle nose with flatness of the nasal tip, the latter has to be lifted by the same procedure, independently of the correction of the saddle nose. The lower surface of the

Fig. 4.—Roentgenogram of Case 1 eighteen months after ivory implantation.

dorsal implant used in rebuilding the nasal bridge and the lateral walls should fit the deformity exactly.

Special attention should be paid to avoiding contact of the ivory with the cutaneous suture points. The danger of this is much increased in the region of the philtrum, and we should try here to isolate the implant from the cutaneous incision by suturing the alar cartilages (internal segments) above it with catgut. The ivory may also be introduced into this region by a horizontal incision at the base of the philtrum; thus a contact with suturing material will be avoided. On account of the danger of infection from sutures, the use of cartilage as a support for the skin septum is preferred.

CONCLUSIONS

1. Cartilage constitutes the best internal prosthesis to employ in rhinoplasty. Slight nasal bridge defects can be completely corrected by an auricular transplant. A complete correction of a pronounced nasal

Fig. 5 (Case 2).—Front view before and after correction by ivory implantation.

Fig. 6 (Case 2).—Before and after correction of ivory implantation (profile).

defect by rib cartilage may be impossible on account of its curvature in the costal arch, which prohibits the removal of a long and straight transplant. The thickness and size of a rib cartilage may also be insufficient to provide a substitute for the missing nasal bridge and

lateral walls. In similar nasal deformities, an ivory prosthesis is indicated.

2. The patient often refuses a complemental operation for obtaining rib cartilage; for this reason, therefore, an ivory implant has to be provided.

3. In its morphologic and clinical structure, ivory resembles human bone closely, and, on account of this fact, when implanted in human

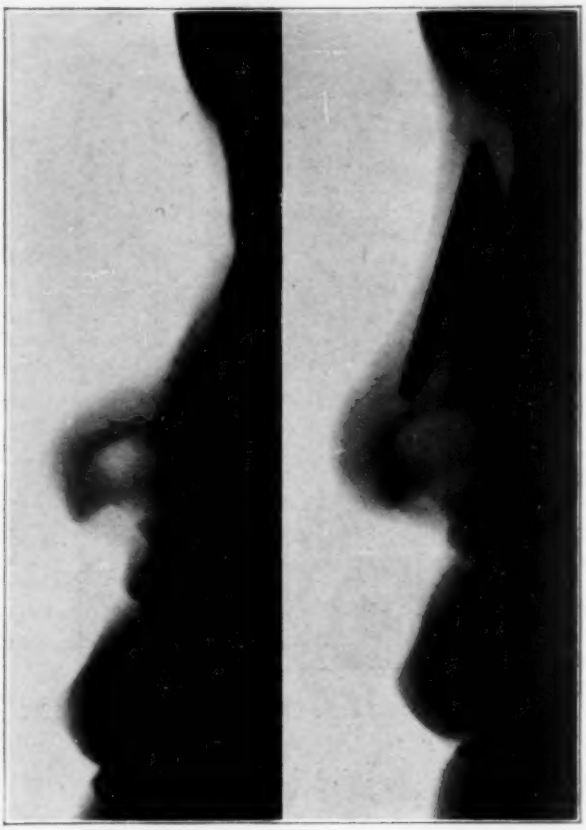

Fig. 7.—Roentgenograms of Case *2* before and six months after ivory implantation.

tissues does not irritate them but becomes encapsulated. Being easy to procure, easily sterilized, practically nonabsorbable and very resistant, it forms an ideal internal prosthesis.

4. Clinical experience with ivory in rhinoplasty confirms the assumption from biologic facts.

5. The numerous imitations of ivory of vegetable origin should be avoided as foreign bodies. A chemical test easily shows the difference.

6. Although a certain tolerance of the organism for celluloid and for gold is demonstrated by clinical experience, these substances have to be avoided in rhinoplasty as they are entirely different in their chemical composition from human tissues. Sooner or later they are rejected as foreign bodies.

The following typical cases demonstrate the indications for the use of ivory or cartilage.

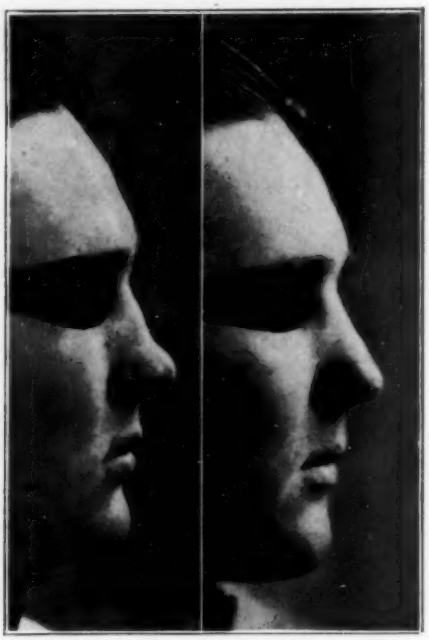

Fig. 8 (Case 3).—Before and after correction by a transplant from auricular cartilage.

REPORT OF CASES

Case 1 (Fig. 3).—C. G., a girl, had a congenital saddle nose with bulged and protruded tip. In July, 1920, a bone implant had been introduced through the endonasal route by a rhinologist and two weeks later the transplant was spontaneously extruded.

Antisyphilitic treatment was given in 1920 and in 1921. In 1923 the Wassermann test was negative and in August of the same year, under local anesthesia, I introduced an ivory implant through an incision made at the glabella. Through the same incision, a piece of bone remaining above the glabella after the first unsuccessful transplantation could be removed. The "negroid wings" were at the same time remodeled by excision of triangular fragments.[1] The normal shape has remained unchanged since.

The roentgenogram of the nose, taken one year after the operation, shows a fibrous capsule around the implant (Fig. 4).

CASE 2 (Fig. 5).—R. B., a girl, had a pronounced saddle nose with extreme flatness of the bony part. The mother of the patient stated that a prolonged suppuration had occurred in early childhood, during which some pieces of bone came out from the child's nose. Following this suppuration, a change in the shape of the nose took place.

I found the nasal lining slightly retracted, and the bony and cartilagenous septum showing a submucous defect along the dorsum. The Wassermann test was negative.

Sept. 9, 1924, correction of the deformity by introduction of an ivory implant through an incision in the left eyebrow was made. A lead splint was worn for ten days, and the wound healed uneventfully. The scar on the eyebrow has disappeared. The extent of the nasal rebuilding may be seen by the roentgenogram of the profile taken six months after the operation (Fig. 7).

CASE 3 (Fig. 7).—B. N., a man, had a congenital nasal deformity, consisting of a snub nose with a medium sized saddle deformity.

This case is presented to show the type of a saddle nose deformity which can easily be corrected by cartilage taken from the auricle. A rib resection is not necessary for the correction of these medium sized defects.

Under local anesthesia, the auricular cartilage was removed from the right auricle through an incision made at its insertion to the mastoid. No change in the shape of the auricle occurred. A skin fold at the anterior surface of the concha sometimes has to be excised after removal of a large fragment of auricular cartilage. In this case the skin excision was not necessary, as only a narrow strip of cartilage was transplanted.

The nasal tip was made thinner by an excision of a strip of alar cartilage on each side of the septum and the nasal splint was worn for ten days.

CAPILLARY HEMANGIO-ENDOTHELIOMA OF THE NOSE*

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The descriptions of the tumors arising in the nose and in the accessory sinuses give rise to considerable confusion and do not appear to be adequately understood either from the clinical or from the pathologic viewpoints. The textbooks have little to say concerning these lesions and the nomenclature is especially confusing. This is particularly true concerning that type of vascular tumor variously described as angioma, angiosarcoma, and hemangio-endothelio fibroblastoma. The reasons for these innumerable diagnoses of the blood vessel neoplasms in the nasal mucous membrane apparently are: the rarity of the condition, the fact that the tissues obtained for histologic examination are very scanty in amount or are traumatized in removal, or the fact that the histologic picture may be altered by previous radium therapy and infection.

PATHOLOGY

Hemangio-endotheliomas of the nasal mucous membrane are designated by many names. Some of the tumors that have been described as angioma, angiosarcoma, hemangio-endothelio fibroblastoma and undoubtedly some of the vascular fibromas are neoplasms of this type. Nevertheless, it is rather difficult from the descriptions to ascertain how many have definitely been proved as such. It seems to us that the classification of hemangiomas must be as singular as our knowledge of the condition and that a new name must not be added for each variation in morphology. The telangiectatic angiomas or vascular nevi are well known; the elongated dilated tortuous vessels and the large spaces filled with blood known as cavernous hemangiomas are not confusing. These two conditions are held by many pathologists as not true tumors. Here, we study the true tumors arising from the proliferation of blood vessels; many names are encountered. Some pathologists object to the diagnosis of hemangio-endothelioma because the endothelium in all cases cannot be proved to be the first cell in the tumor that began to grow. In a tumor of blood vessels in which the fibrous tissue must keep pace with the rapidly forming new vessels, frequently it is difficult to determine which is the actively growing cell.

If proved definitely of blood vessel origin regardless of histology, a tumor has almost the same life history, namely, growth, local invasion and

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rare metastases. The rarity of the metastases can best be understood when a pathologist with Dr. Mallory's experience states that he is aware of only two blood vessel tumors having metastasized. The histology, on the other hand, is very important in determining the rate of growth and invasion. It seems, then, that the diagnosis in each case must be angioma or hemangio-endothelioma.

The endothelial cells in the most cases are abnormal in size and in shape, and to prove that the tumor arises from the endothelium of blood vessels is difficult and at times impossible. Many times definite proliferation can be noted. The abnormality and proliferation of endothelial cells have led us to prefer hemangio-endothelioma as a diagnosis.

The case presented here yielded good histologic material so that a definite diagnosis could be made. This fact, together with the subsequent outcome of the case and the finding of similar cases histologically and clinically, seems to warrant a report of this case. The review of the condition is an endeavor to place this type of tumor on a firm basis both clinically and pathologically.

CASE REPORT

History.—F. H., a man, aged 48, for two years suffered from impaired breathing through the right nostril and occasional nosebleed.

Examination revealed nothing significant or abnormal other than this local trouble. One nostril was filled with a dark bluish red, fairly dense tumor which bled easily. A roentgenogram showed a shadow in the right nostril, the maxillary sinus was clear but the right anterior ethmoidal cells were somewhat blurred as compared with the left.

The blood Wassermann test and urinalysis were negative. No adenopathy was discernible.

The chest showed no signs of metastases or other pathologic conditions. July 15, 1924, an operation under local anesthesia was performed by Dr. L. W. Dean. By means of a snare, the tumor was removed from the right middle meatus. It measured 1.5 inches (3 cm.) in length and about 0.5 inch (1.2 cm.) in diameter. This polypoid material was dark red, tense, and had a smooth covering which seemed to be attached to the ethmoidal labyrinth. No primary hemorrhage was encountered. The base of the tumor was cauterized with the electric cautery. One month later there was no evidence of recurrence, but 200 mg. hours of radium was applied to this area as a precautionary measure.

On Feb. 11, 1925, when the patient was again seen, there was no evidence of recurrence.

Pathologist's Report.—Gross Description: The specimen consisted of several fragments of tissue, the largest measuring 4 cm. in diameter. It was red and soft in consistency but definitely elastic. Scattered through the tumor were areas of hemorrhage, some of which measured 5 mm. in diameter. The condition was definitely a tumor.

Microscopic Description.—The most striking factor in the histology of this tumor was the vascular element. The vessels varied in size as far as the lumina were concerned but they were practically all thin-walled and the vast majority were of capillary size. The vessels were lined with endothelium that was variable in its morphology, especially so far as height was concerned. Along the sides of these vessels were large branching cells showing mitotic figures.

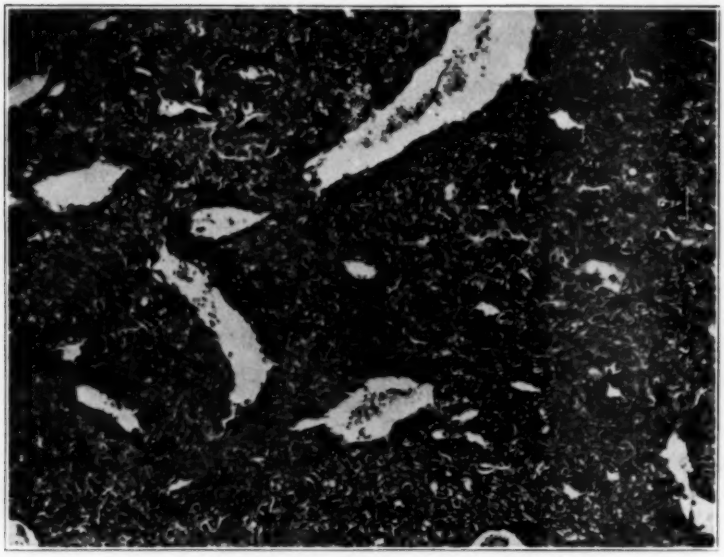

Fig. 1.—Many capillaries separated by loosely textured fibrous tissue (× 80).

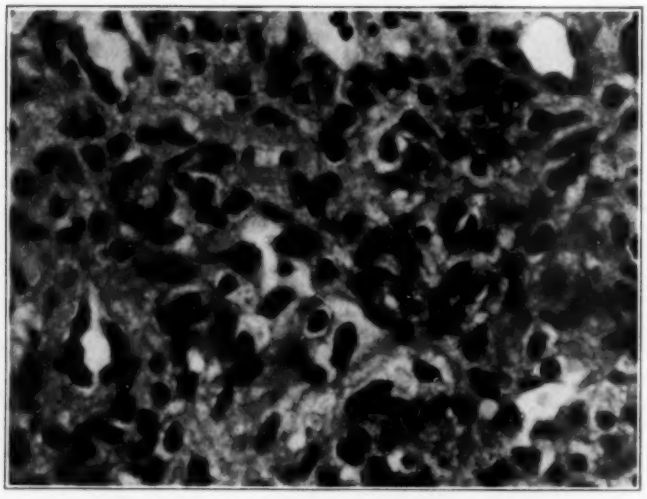

Fig. 2.—Numerous cell capillaries lined by cuboidal endothelial cells (× 200).

The vessels were embedded in loose fibrous tissue, which in places was quite dense.

Scattered throughout the tumor were many mononuclear cells, and areas of hemorrhage and of repair were frequent.

REVIEW OF THE LITERATURE

Knauer,[1] in 1920, reported a case of capillary hemangio-endothelioma arising from the right middle turbinate. In this article she reviewed the literature and found two acceptable cases of hemangio-endothelioma. One was reported by Roth [2] and the other by Schreiber,[3] the first arising from the right middle turbinate and the ethmoidal region, the latter invading the orbit, resulting in panophthalmitis and death.

Crowe [4] reported a similar type of tumor, with no return after operation.

Gerber [5] treated with radium a boy who had a tumor in the right nostril, which was diagnosed by Mallory as an hemangio-endothelio fibroblastoma. There was no evidence of neoplasm after 200 mg. hours of radium.

Two cases at the Massachusetts Eye and Ear Infirmary [6] were similarly diagnosed—both tumors were removed from the nares and later the patients received radium therapy. There were no recurrences.

COMMENT

As to the treatment of this type of vascular tumor it has been found that radium therapy has produced remarkable cures. However, some patients have required surgery combined with radium treatment to bring about the desired effect.

Those tumors which are not treated early not only become infected, ulcerate and bleed profusely, but also may destroy the surrounding structures by pressure and grow into the orbit, paranasal sinuses and intracranial cavity.

The cases here mentioned appear proved. From this review we conclude that capillary hemangio-endotheliomas of the nose are rare;

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1. Knauer, Ilse: Ueber einen Fall von kapillarem Haemangio Endotheliom in Mittleren Nasengang Mit Besonder Berücksichtigung seiner Genese, Arch. f. Ohren,- Nasen- u. Kehlkopfheilkunde **105**:14-32, 1920.

2. Roth: Ueber einen Fall von blutendem Septumtumor, Arch. f. Laryngol. **16**:525, 1904.

3. Schreiber: Ztschr. f. Krebs., 1910.

4. Crowe, S. J., and Baylor, J. W.: Benign and Malignant Growths of Nasopharynx and Their Treatment with Radium, Arch. Surg. **6**:429-488 (March) 1923.

5. Personal interview with Dr. I. Gerber, Providence, R. I.

6. Personal communication with Dr. F. H. Verhoeff and Dr. H. Finck, Eye and Ear Infirmary, Massachusetts.

yet not so uncommon as the literature is apt to lead one to believe because of the unreported cases and of those wrongly diagnosed.

The tumor referred to in this paper was submitted to Drs. S. B. Wolbach, F. B. Mallory, J. H. Wright and W. G. MacCallum. Dr. Wright's diagnosis was angiosarcoma; Dr. Wolbach and Dr. Mallory considered it hemangio-endothelioma, and Dr. MacCallum diagnosed it hemangioma. This type of tumor is, therefore, on a firm basis as a capillary tumor of blood vessel origin.

PEMPHIGUS FROM THE LARYNGOLOGIST'S STANDPOINT *

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Pemphigus is a disease characterized by the development of bullae of the skin and mucous membranes, by remissions, and usually by progressive failure and death. Most physicians believe it to be a dermatosis which occasionally affects the throat and mouth, but only if the lesion has existed on the skin for some time, or if the disease has become generalized. It is our purpose to emphasize the characteristics of the early lesions of the mucous membrane of the throat and mouth so that, with a dermatologic examination, an early diagnosis may be made.

During the last five years, from 1919 to 1924 inclusive, we have examined twenty-nine patients with pemphigus at the Mayo Clinic. Of these, nineteen (more than 65 per cent.) came primarily on account of the lesions of the mouth and throat. Some of the patients had no other lesions on the body at the time of the original examination or they were so slight as not to be recognized by the patient. A diagnosis, or a tentative diagnosis, was made from the lesions of the mouth or throat, which was later corroborated by dermatologic examination and the further progress of the disease. If the disease is primarily of the skin, the laryngologist is not consulted, as the dermatologist expects involvement of the mouth and throat. The early diagnosis of the disease is essential on account of the usual fatal outcome, which may occur within a few months.

ETIOLOGY

The cause of pemphigus is not definitely known, although it has been attributed to many different organisms. *Bacillus pyocyaneous* has been obtained from the exfoliative type of the disease by several investigators. Evidence favoring a bacteriologic cause continues to accumulate, and undoubtedly will eventually be demonstrated by further study. It has been noticed that, in a large percentage of this series of twenty-nine cases, the onset of the disease was in the summer months, especially in August. This may serve as a starting point in the determination of the cause of the disease.

* Read before the American Laryngological Association, Washington, D.C., May 4-6, 1925.

TYPES

Pemphigus is usually classified as four types: (1) pemphigus acutus, (2) pemphigus chronicus, (3) pemphigus foliaceus, and (4) pemphigus vegetans. While this classification has little bearing on the present paper, it might be said that the pemphigus acutus is a fulminating type of the disease, ending in death within a few weeks or months. Occasionally, however, the acute symptoms subside and the patient recovers completely or the disease takes on a chronic form. Pemphigus chronicus or vulgaris is the most common type, the name of which is self-explanatory. Pemphigus foliaceus is characterized by the formation of bullae, followed by generalized exfoliation. The mucous membrane in this type usually is affected late in the disease. Pemphigus vegetans is the rarest of the four types, usually found primarily on the mucous membrane, lesions on the skin appearing later and differing from the chronic pemphigus in that the base of the bulla becomes papillomatous or condylomatous around the genital, crural and axillary regions. The benign type of pemphigus may last for a period of years.

AGE, SEX, NATIONALITY AND DURATION OF THE DISEASE

The age varied from 20 to 76 years, most of the patients being about middle age. There were eighteen females and eleven males. It has previously been emphasized that a high percentage of Russian Jews are affected with this disease. In our series there were six, a high percentage as compared with the percentage of patients of this nationality coming to the clinic. The disease had existed for from two weeks to seven years before the patient was examined at the clinic, the average duration being eighteen and one-half months.

SYMPTOMS AND PREVIOUS TREATMENT

As a rule, the patients complain of a sore throat or mouth, difficulty in swallowing and increased salivation. They usually have consulted several physicians, have had various diagnoses and much treatment. The treatment has consisted of vaccine with streptococcus, staphylococcus and diphtheria serum; silver nitrate, chromic acid, radium, and copper sulphate have been applied; tonsillectomy and dental extractions have been performed; solutions of potassium arsenite (Fowler's solution), by mouth, and routine treatment for tuberculosis have been given.

TYPE AND LOCATION OF THE LESIONS

Of the nineteen patients who came for examination primarily because of lesions of the mouth and throat, the condition eventually was diagnosed as pemphigus acutus in one patient, pemphigus vegetans in

eight patients, pemphigus chronicus in six and mixed pemphigus in four. The mouth was affected in nineteen, the pharynx in fourteen, the larynx in eleven, the esophagus in one, the nasopharynx in one and the nose in one. Although the vegetans type of lesion is usually considered the rarest, eight of the series were of this type.

Five of the nineteen patients had no cutaneous involvement. In one the conjunctivae, in six the skin, in three the conjunctivae and skin, in two the conjunctival, vaginal and rectal mucous membranes, and in two the conjunctival and vaginal mucous membrane and skin were involved.

CHARACTER OF THE LESIONS OF THE MUCOUS MEMBRANE

The lesions of the mucous membrane in the various types of pemphigus all present similar pictures. The type of pemphigus cannot be distinguished from the early lesions of the mouth and throat. Not all lesions of a bullous character are pemphigus. It has been noted that the first lesions on the mucous membranes of the mouth and pharynx are rarely seen in the bullous stage without other dermatologic findings. We have been so fortunate as to recognize many cases in which this was the only lesion, and later the diagnosis was corroborated by the course of the disease.

Patients frequently describe their lesions as "a small blister the size of a pea," which later ruptures. Several bullae may appear in a crop; as many as eight have been observed at one time. They may be of various sizes, and be round or oval. During the first few months of the disease, bullae may last for twenty-four hours, but as the disease becomes more chronic, the bullae may appear and break within an hour. The lesions appear on healthy mucous membrane. Bullae at first may not be apparent on the mucous membrane but there is a fibrinous exudate, and the bullae are found later only on careful examination. The possibility of the formation of bullae that rupture early should be considered as a cause of the fibrinous exudate. It has been necessary in some cases to observe the lesions several times a day, in order to recognize a bulla before it ruptured. After it ruptures, the remaining pedicle may be observed hanging loosely or collapsed on the mucous membrane, particularly around the lips. The resulting erosion of a solitary bulla is usually superficial, and may heal in from three to four days, while if the lesions are numerous the ulceration may extend over a considerable area, or there may be multiple ulcerated patches.

In the severe cases the mucous membrane of the mouth, pharynx and larynx may, to a great extent, be covered with a beefy-red ulceration and fibrinous exudate. A slight inflammatory reaction (which is usually irregular) occurs around the lesions, with projections or islands of the

normal mucous membrane extending into the ulcerated or eroded areas. A fetor typical of the disease is present, and the secretion of saliva is usually markedly increased. In the mouth and throat the absence of scarring, as a rule, is conspicuous, although it may occur and may

Fig. 1.—Ulcerations with irregular margins over the soft palate, and involvement of the lips.

Fig. 2.—Areas of exudate over the posterior pharyngeal wall and palate, and two blebs on the soft palate and anterior pillar.

cause laryngeal obstruction; however, on the conjunctivae it occurs frequently. With ulceration of the mouth and throat, often with the fibrinous exudate and increased saliva, pemphigus should be suspected at the time of the primary examination and the patient immediately

referred to a dermatologist for further investigation. After repeated examinations, a bulla may be found on the mucous membrane. Of the patients who came primarily on account of the condition of their mouth and throat, and later developed lesions of the skin, the interval between

Fig. 3.—Necropsy specimen. Bleb on the outer surface of the larynx.

the appearance of the mucous membrane and skin was from a few weeks to three years. It is believed that the more rapid the appearance of the cutaneous manifestations following lesions of the mouth and throat, the more virulent and rapid is the course of the disease (Figs. 1, *2* and 3).

TYPES

Pemphigus is usually classified as four types: (1) pemphigus acutus, (2) pemphigus chronicus, (3) pemphigus foliaceus, and (4) pemphigus vegetans. While this classification has little bearing on the present paper, it might be said that the pemphigus acutus is a fulminating type of the disease, ending in death within a few weeks or months. Occasionally, however, the acute symptoms subside and the patient recovers completely or the disease takes on a chronic form. Pemphigus chronicus or vulgaris is the most common type, the name of which is self-explanatory. Pemphigus foliaceus is characterized by the formation of bullae, followed by generalized exfoliation. The mucous membrane in this type usually is affected late in the disease. Pemphigus vegetans is the rarest of the four types, usually found primarily on the mucous membrane, lesions on the skin appearing later and differing from the chronic pemphigus in that the base of the bulla becomes papillomatous or condylomatous around the genital, crural and axillary regions. The benign type of pemphigus may last for a period of years.

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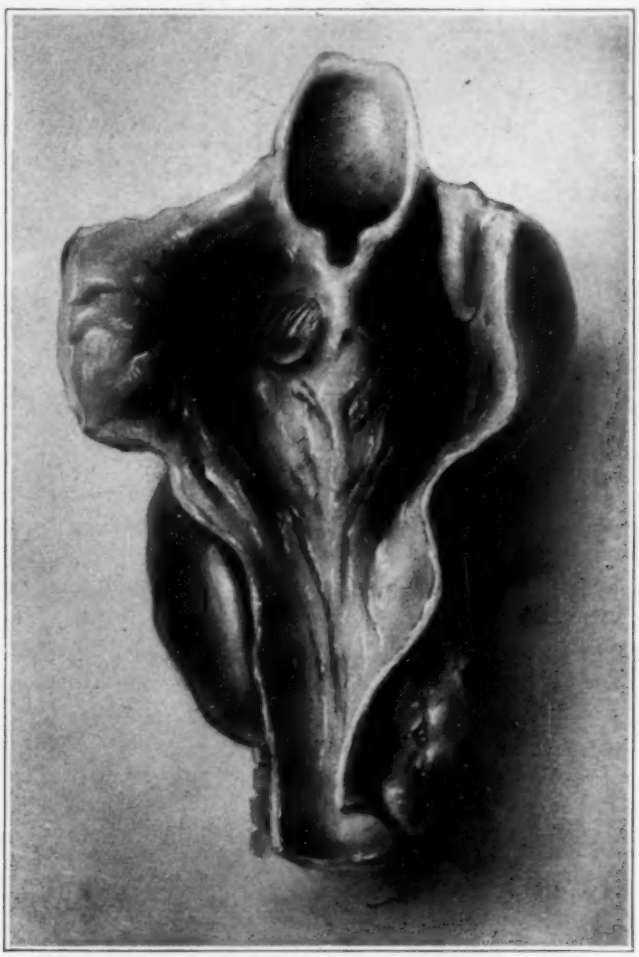

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DIAGNOSIS

The diagnosis of pemphigus from the laryngologist's standpoint must depend on the history, the finding of the lesions of the mouth or throat that makes one suspect the disease, and after repeated observations the finding of bullae on the mucous membrane. In all such cases, a dermatologist should be consulted. Lesions in the mouth and throat that simulate pemphigus are erythema multiforme and sprue. Other diseases, such as syphilis, Vincent's angina, and ulcerative and aphthous stomatitis, are usually included in the differential diagnosis, but as a rule would not be considered by an experienced laryngologist. The progress of the disease, with involvement of the skin or other mucous membranes, is often confirmatory evidence.

TREATMENT

Present methods of treatment of the various types of pemphigus are not satisfactory. The use of coagulen and iron cacodylate, as suggested by Davis and Davis,[1] has apparently been attended with varying degrees of success. Wende [2] reports that nine patients were definitely benefited by this method, but in our experience there has been practically no improvement. The occasional brilliant result, however, justifies further trial of the method. The use of immune serum made from the bacterium of pemphigus (Eberson [3]) has not met with encouragement. The intravenous injection of mercurochrome, gentian violet and many other preparations has not been beneficial.

Treatment of the mouth and throat lesions is likewise unsatisfactory as a rule. The lesions of the mucous membrane usually run a parallel course with the lesions of the skin. A few cases have been observed in which the former cleared up while the latter persisted to a fatal termination. In the vegetative type of the disease, the lesions of the mucous membrane are more pronounced, persistent and troublesome. All foci had usually been thoroughly eliminated before the patient presented himself for examination. In those in whom the teeth or tonsils were cared for under our supervision, it seemed that this has only aggravated the disease.

CONCLUSIONS

1. Contrary to the usual opinion, patients with pemphigus as a rule consult a laryngologist primarily, on account of trouble in the mouth and throat.

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1. Davis, R. H., and Davis, W. D.: A Contribution to the Treatment of Pemphigus, Arch. Dermat. & Syph., **8**:627-638, 1923.

2. Wende, Grover: Results in the Treatment of Pemphigus, Arch. Dermat. & Syph., (In press).

3. Eberson, Frederick: Studies on the Etiology of Pemphigus. I. Bacteriologic Findings in a Group of Cases of Pemphigus, Arch. Dermat. & Syph., **8**:204-232, 1923.

2. Many patients with pemphigus are given much treatment without a definite diagnosis.

3. The rapidity with which the cutaneous manifestations follow lesions of the mouth and throat is an index to the virulence of the disease and to the length of life.

4. Early diagnosis of pemphigus is essential, in order that relatives may be given a prognosis, and that early institutional treatment for the patient may be obtained.

CICATRICIAL STENOSIS OF THE TRACHEA

REPORT OF THREE CASES *

CHARLES J. IMPERATORI, M.D.
NEW YORK

ETIOLOGY

The usual cause of cicatricial stenosis of the trachea is an injury or a wound of sufficient depth to destroy the submucosa. Typhoid fever, diphtheria or any disease producing ulceration of the mucosa is undoubtedly the cause of those so-called idiopathic cases. Gunshot or high explosive wounds of the trachea must have caused many such injuries during the World War, but none from these causes has been seen by me. Poorly performed tracheotomies and repeated and prolonged intubation for diphtheritic stenosis appear to be the most common causes for such injuries.

In order that these cicatrices or webs shall form, there must necessarily have been considerable destruction of the mucosa, particularly in the transverse diameter of the trachea. The loss in continuity of the mucosa is replaced in the normal process of repair by a callus, which, in turn, becomes covered by the adjacent mucous membrane. A cross section of a web will show two layers of epithelial cells and between them a stroma of connective tissue, with fibrous tissue of increasing density as the tracheal wall is approached. It is the contraction of the callus that produces these thin, web-like structures, stretching around the lumen of the trachea from each end of the wound. The general outline of these cicatrices is irregularly falciform, with the thin edge directed toward the lumen of the trachea.

REPORT OF CASES

CASE 1.—*History.*—Mrs. A., aged 42, was operated on for a papilloma of the vocal cords about fifteen years previously. Two days following the laryngeal operation, because of marked and increasing dyspnea, it became necessary to perform an emergency tracheotomy. She wore a tube for four and a half years, and the cannula was removed by the late Dr. Janeway. Since that time she has had some treatments, including the application of radium by a physician who was not a laryngologist, and, so far as can be ascertained, these treatments seem to have been in the nature of dilations.

The patient was first seen in August, 1924, having been referred by Dr. Alfred A. Schwartz. At this time she complained of considerable dyspnea, accompanied by a marked stridor. Each inspiratory effort was such that there was marked depression of the episternal notch, and it was evident that there was considerable interference in the larynx or trachea. The

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* Read before the American Laryngological Association at the Annual Meeting, Washington, D. C., May 4-6, 1925.

general appearance was that of one suffering from increasing air hunger. She had no speaking voice and was of an ashen gray appearance. The slightest exertion produced increasing dyspnea. Externally, over the cricoid and extending slightly diagonally, was a puckered scar, rather irregular in outline—the mute evidence of a hurried tracheotomy done high up, mostly through the cricoid and first ring of the trachea.

A laryngoscopic examination showed a rather dense infiltration of the right aryepiglottic fold and a considerable degree of laryngeal stenosis, especially in the anterior commissure.

The patient was hospitalized, to ascertain by direct examination whether there was any tracheal stenosis, for it did not seem that the laryngeal stenosis

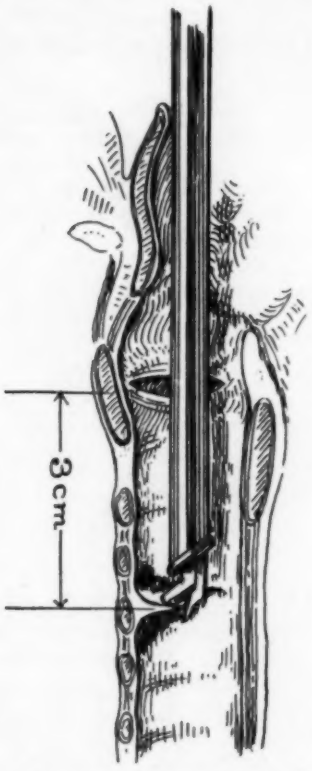

Fig. 1.—Location and method of operation in Case 1.

was sufficient to cause the marked dyspnea. Under local anesthesia, a 7 mm. Jackson bronchoscope was passed with some difficulty through the glottis. A little over 3 cm. below the vocal cords, a falciform web was seen, extending around the trachea and occluding over two thirds of the lumen. With a punch forceps this web was easily excised, resulting in immediate cessation of the dyspnea. The patient rapidly improved, and was in such good condition within two days that she was permitted to leave the hospital.

A week later, dilation was done with a No. 24 French Lynah laryngeal dilator; at intervals of a week for four weeks dilation was done with increasing sizes, so that at the fourth dilation—five weeks after the excision of the cicatrix—a size No. 30 French was passed. Dilation has been performed four

times since, the last interval having been three months. In all, seven dilations have been done.

The dilations were done under what has been facetiously termed "vocal anesthesia," through a Jackson laryngoscope and using the Lynah dilators. A very short interval of time is required to pass two or three of these dilators.

In general, this patient has improved remarkably, and while she has not a good speaking voice, for all practical purposes it is very satisfactory. The infiltration of the aryepiglottic fold still remains. The vocal bands move freely, but there is an ankylosis of the arytenoid joint on the right side. The patient experiences no dyspnea, even on extraordinary exertion.

Case 2.—*History.*—M., a girl, aged 3 years, was referred to me by Dr. George Berry of Brooklyn, N. Y., in December, 1922. Three months previously she had severe laryngitis. The child was treated for diphtheria and, because of the marked laryngeal stenosis, intubation was done. The tube was fre-

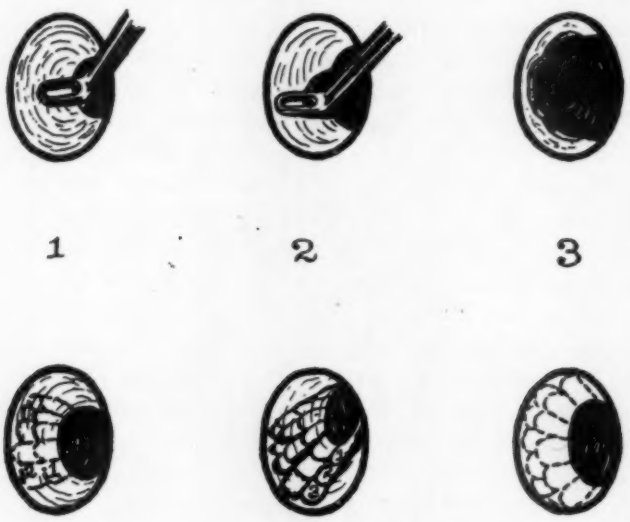

Fig. 2.—The method of excision with the Struycken's punch. Cases 1, 2 and 3.

quently coughed out, and re-intubation was done several times. About three weeks previous to the time that I saw her, a tracheal web was seen by a colleague, who divulsed it, using a bronchoscope. Within a few weeks, however, there was a recurrence of the tracheal obstruction accompanied by marked cyanosis.

Examination through a child's size Jackson laryngoscope showed a falciform web about 1 cm. below the glottis, which was attached to over two thirds of the circumference of the tube. It occluded over half of the lumen of the trachea.

Using a punch forceps, the cicatrix was partially removed and a two-years O'Dwyer intubation tube was introduced. This was left in for four days and then was removed. The trachea was dilated subsequently eight times, getting up to No. 26 French each time, the dilations extending over a period of one year. Results were immediate, and within a few weeks the child began to gain in weight. One year after the excision of the cicatrix, a tracheoscopic examination, using a 5 mm. Jackson bronchoscope, showed no evidence of the site of the web. Two years after the operation, the child was again examined, with the before-mentioned results.

It seemed that the mere breaking up of the web was not sufficient, and that as much of it as possible should have been removed in order to lead to such conclusive results.

CASE 3.—While I was a member of the attending staff of the oto-laryngological service of Bellevue Hospital, through the courtesy of Dr. Coakley, D. E., a woman, aged 35, was referred to me for endoscopic examination. This was in April, 1921. The patient had been attacked and slashed with a razor in July, 1912. She was taken to Bellevue Hospital, in an unconscious condition and with considerable emphysema of the neck and chest. The razor slash had opened the trachea at the second ring. The wound was immediately sutured, no tracheotomy tube having been inserted.

Since that time she had complained of increasing dyspnea on exertion, and at times she had had severe smothering attacks. She was treated by her physician and was given heroin in increasing doses until she became a drug addict, and when seen she was confined to the prison ward of the hospital.

Bronchoscopic examination, using a 7 mm. Jackson bronchoscope, revealed a falciform web stretching around the trachea that occluded almost three fourths of the lumen. It was situated 2 cm. below the glottis, was rather flaccid and moved with each respiration.

The web was excised through the bronchoscope, using the punch forceps. Afterward, dilation was done through the laryngoscope, using a Lynah No. 26 French laryngeal dilator. There were three subsequent dilations. This patient never complained of any urgent dyspnea, but was somewhat cyanosed.

Following the excision and dilation, she improved rapidly, stopped taking the heroin, but substituted cocain for it. However, up to two years ago, when she was lost track of, she was free from any respiratory obstruction.

SUMMARY

The etiologic factors were as follows: In Case 1, the cause was a poorly performed tracheotomy, following a laryngeal operation; in Case 2, diphtheric erosion and repeated and prolonged intubation caused the cicatricial stenosis, while in Case 3 the resultant scar followed a razor slash.

All these webs were located mostly on the anterior wall of the trachea. The distance from the glottis was 3 cm., 1 cm. and 2 cm., respectively. The predominating shape was irregularly crescentic, with the concavity directed posteriorly.

The most prominent symptoms were increasing dyspnea and some hoarseness. In the first patient, the hoarseness was of long standing and was due to the ankylosis of the crico-artenoid joint on one side; while in the other two, there was chronic catarrhal laryngitis. Cyanosis was marked up to the time of operation.

All patients were operated on by the direct method, using a laryngoscope or bronchoscope and a Struycken's punch forceps, and the treatment was continued by graded dilations.

Patient 3 was under observation for two years after the excision and completed dilation, during which time she remained free from any respiratory difficulty. Patients 1 and 2 have been observed for nearly a year and two and one-half years, respectively, and both are

free from complaints relative to tracheal obstruction. All have a good speaking voice, except Patient 1, who has an ankylosis of the right arytenoid joint.

Careful inspection of these patients fails to show the site of the cicatricial webs.

It seems that it is better practice to excise the web and then to continue treatment by graded dilations after epithelization of the remains of the web has occurred. This appears to be the method of choice and seems to lead to more permanent results.

These cases will be further observed and reported on at some future date, for one cannot be unmindful of the case reported by Drs. Keen and Jackson—a tracheal web that was excised by Dr. Keen some twenty years previous to the dilations performed by Dr. Jackson.

It almost seems that these patients may be classified with those of cicatricial stricture of the esophagus, and that at least some of them will be potential patients for dilation the rest of their lives.

DIAGNOSTIC BRONCHOSCOPY

IN AN INFANT AGED FOUR MONTHS

ELLEN J. PATTERSON, M.D.
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PITTSBURGH

REPORT OF CASE

History.—J. T., a girl, aged 4 months, referred to me by Dr. H. T. Mather, Latrobe, Pa., was admitted to the Presbyterian Hospital with a history of having been dyspneic for seven weeks. At first she had attacks of choking, at which times she breathed with difficulty. These attacks became worse so that the paroxysms of severe dyspnea and coughing prevented nursing, the attempts at nursing seeming to increase the difficulty in breathing. Because of this, the baby had not slept well for seven weeks.

On admission, the child appeared fairly well nourished, breathed with difficulty, cried a great deal in a clear voice, appeared sick and seemed weak and very tired. Notwithstanding the clear voice, the cardinal sign of laryngeal dyspnea—indrawing at the suprasternal notch—was unmistakably present.

The parents did not speak English, but through an interpreter we learned that there was no knowledge of a foreign body having been aspirated and that the baby had been sick and fretful for seven weeks and very sick for three weeks. Previous to the present illness, the mother stated that the baby never cried and always wanted to smile and play.

On examination, Dr. G. W. Grier reported: "The roentgen-ray examination of the baby shows an emphysema of the right lung. The heart and great vessels are displaced to the left. The right diaphragm is depressed and fixed. These signs are all characteristic of transparent foreign body plugging the bronchus and we would be suspicious of such a condition in this case. The emphysema involves the entire right lung and for this reason we would think that the foreign body is probably in the main bronchus."

Dr. J. H. Barach, on examining the chest reported: "Diffuse moist râles louder on the right. Bronchitis with possible plastic pleurisy. On the left side the sounds are quieter but present all over. No suppressed breathing on the left side." In view of these signs and the roentgen-ray findings, he advised bronchoscopy.

Urinalysis.—The urine was acid and showed traces of albumin and of pus.

The nurse reported that the baby slept for short intervals, and then awakened, coughing and crying. The respirations were quite labored when the child attempted to nurse, and nursing caused coughing, crying and vomiting. After twenty-four hours' observation, I decided that bronchoscopy was urgently indicated.

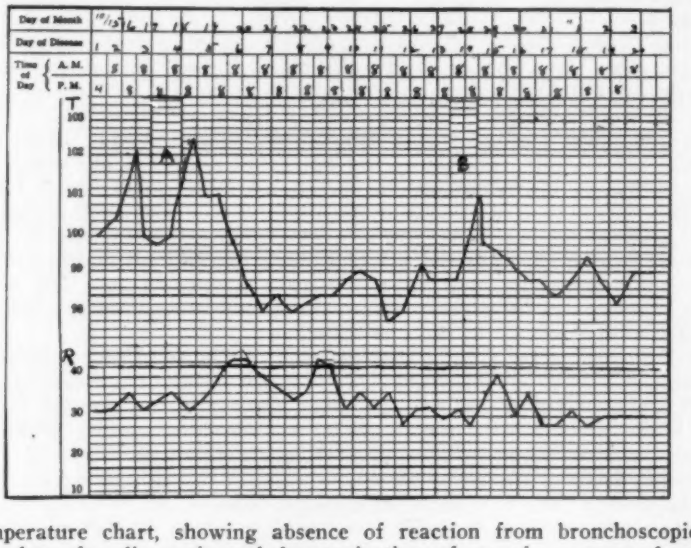
First Bronchoscopy.—On the third day after admission, without anesthesia, I passed a 4 mm. bronchoscope and found that the trachea and the right bronchus were full of pus. After aspirating the pus, I found an intense tracheobronchitis and much swelling of the mucosa but no foreign body. The duration of the bronchoscopy was five minutes and the child bore it well. After bronchosopy, the breathing was labored and ten hours later the child was very dyspneic, but as the color remained good I did not do a tracheotomy.

Two days after the bronchoscopic aspiration of the pus, the child began to improve. She had less dyspnea, though breathing was labored while at the breast. She nursed better and slept much longer at a time.

Three days after bronchoscopy the baby showed so much improvement that she began to play, and the nurse reported that at times the breathing was so quiet she had to put her ear down to hear it. The heavy breathing was still noticeable during nursing. The temperature was normal.

On the eighth day after bronchoscopy, a second roentgen-ray examination showed the same condition as was first noticed, and as the child still had severe paroxysms of coughing with the same physical signs, I decided to perform a bronchoscopy again.

Second Bronchoscopy.—On the ninth day after the previous bronchoscopy, I passed the 4 mm. bronchoscope without anesthesia. There was a little pus in the trachea and right bronchus and the edematous condition of the mucosa was much improved. A careful search revealed no foreign body. The bronchoscopy lasted for seven minutes and the child showed no reaction from



Temperature chart, showing absence of reaction from bronchoscopies (*a* and *b*) done for diagnosis and for aspiration of pus, in a case of vegetal bronchitis in an infant aged only 4 months.

it. There was very little dyspnea following this bronchoscopy but the cough was more marked. The following day the baby was much improved and the breathing was much quieter during sleep than when awake, with very little cough.

Twelve days after the first bronchoscopy, the baby slept through the entire night, breathing quietly, and nursed, laughed and played during the day.

Third Roentgen-Ray Examination.—The report from Dr. Grier was as follows: "The condition of this chest is much improved. There is still emphysema of the right lung but not nearly so marked as at the last examination.

As the child was sleeping quietly now most of the twenty-four hours, nursing well and seemed quite normal, I allowed the mother to return home on condition that she would bring the baby back in three weeks for observation. I have not seen the baby since, but the mother wrote that the child was so well that she did not need a doctor.

A careful search was made of all sponges used in swabbing the bronchus to find threads, crumbs of nut kernel or other nonopaque foreign body, but with negative results.

CONCLUSIONS

1. It seems probable that there had been a nonopaque foreign body aspirated and later coughed up just prior to bronchoscopy, and that the thick pus and mucosal edema caused by the presence of the foreign body gave rise to symptoms similar to foreign body in the bronchus. This condition of postforeign body bronchial obstruction with a clearing sequence so commonly occurs in patients from whom we have removed a nut kernel as to warrant the conclusion that this was a case of vegetal bronchitis.

2. Coughing up of a foreign body does not always relieve a child of dangerous symptoms, and bronchoscopy may be necessary to remove obstructing plugs of pus and secretions.

3. Bronchoscopic aspiration of pus and secretions is a life saving measure in bronchial obstruction due to secretions that an infant may not be able to expel.

4. Diagnostic bronchoscopy is indicated in patients in whom the physical signs show bronchial obstructions, and the indications are especially urgent when the roentgenogram shows signs of obstructive emphysema.

5. Bronchoscopy through the mouth, when carefully done without anesthesia, not too prolonged, and with the necessarily delicate instruments we use, is so safe a procedure, even in infants, that it may be resorted to without hesitation when the diagnostic problem calls for inspection of the interior of the trachea and bronchi.

Westinghouse Building.

CLOSURE OF LARYNGOSTOMIC FISTULAS*

CHARLES F. NASSAU, M.D.
PHILADELPHIA

The closure of fistulas of the larynx and trachea is a problem which presents itself after the laryngologist has completed his treatment of a patient. It is of academic interest only whether the obstruction which preceded the laryngostomy was caused by scar contraction, bilateral recurrent nerve paralysis, gunshot injury or stab wound. Closure of the fistula, independent of the cause, is carried out in the same way.

ANESTHESIA

Consideration must be given to the method of anesthesia, which is of vital importance in these cases. A general anesthetic is difficult to administer; furthermore, the respiratory excursions of the larynx during general anesthesia would be embarrassing while introducing the necessarily large number of fine sutures. Coughing, vomiting and the secretion of mucus in the trachea are other disadvantages.

Under local anesthesia, there is no limitation of the amount of time that may be consumed in operation, and the patient breathes normally throughout. The seven patients in this series were operated on under local anesthesia and only one patient complained of pain. The youngest patient in the series, aged 11 years, gave just as full cooperation as the adults.

METHOD

Field block is the method of choice, and procain in 0.5 per cent. solution, with the addition of 6 minims of epinephrin chlorid to each ounce of solution, is the preferred anesthetic. Infiltration of the flap itself is not necessary, and should be avoided on account of possible interference with healing.

Heretofore the closure of these fistulas (Fig. 1) has been a very uncertain surgical procedure, and in about 50 per cent. of cases the closure has not been permanent. At the request of Dr. Chevalier Jackson, I devised a method which has given excellent results in the patients operated on in this manner.

METHOD OF CLOSURE

A number of points must be given careful consideration if the end-result is to be satisfactory. The theoretically perfect operation demands that no narrowing of the air passage be produced, that the new lining

* Read before the Section on Otology and Laryngology of the College of Physicians of Philadelphia, Feb. 18, 1925.

shall consist of skin, that the closure shall be made up of more than a single layer, that an adequate blood supply shall be present to guarantee the vitality of the reconstructed part, and that absolutely no tension on the sutures shall exist after the procedure has been finished.

Encircling the fistulous area and inversion of the tract were not considered, as this would narrow the air passage, and the tissues utilized

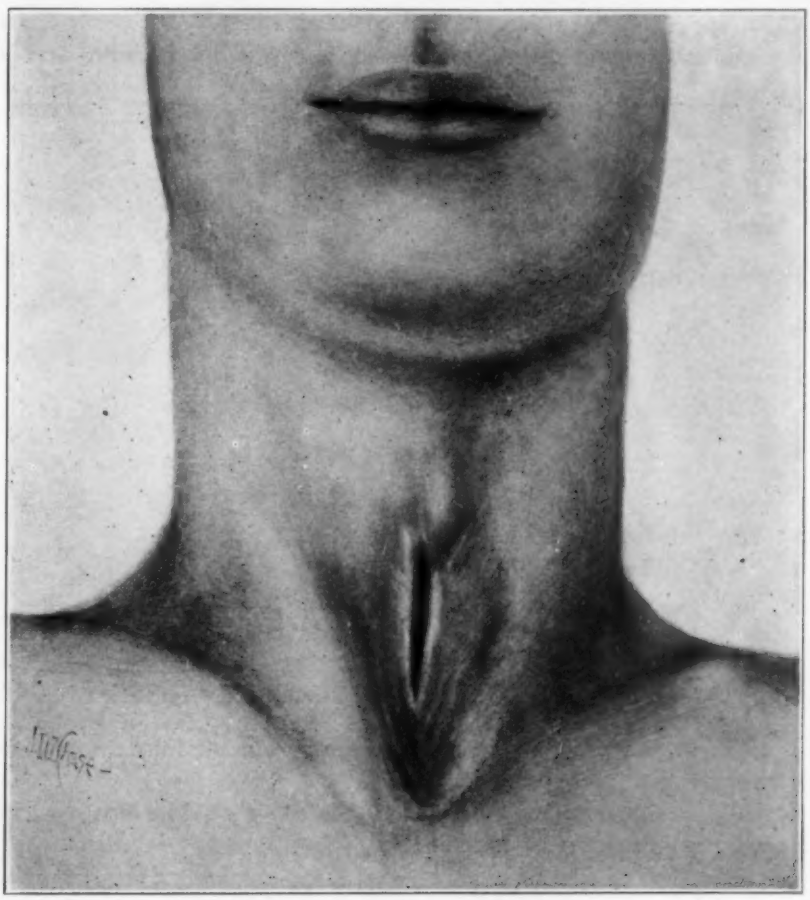


Fig. 1.—Laryngostomic fistula.

would have a poor blood supply because they would consist chiefly of scar. To turn back a flap from one side across the fistula would necessitate sutures on three sides of the flap, and the raw area left by the turning over of the flap from the side is not so easily covered as one taken from the median line. Moreover, this method might leave a line of raw surface on the newly formed anterior wall of the larynx and trachea.

I therefore planned to bring the flap from below the opening, with its base attached to the lower edge of the fistula. By doing this, skin and fat which have a fair circulation can be secured, and the narrowness of the flap obviates any difficulty in bringing the superficial wound together in the median line.

Operation on patients who are suffering with the slightest degree of bronchitis or coryza must be postponed.

No special preoperative preparation is necessary. Great care must be used, however, in disinfecting the skin, whether it be with alcohol

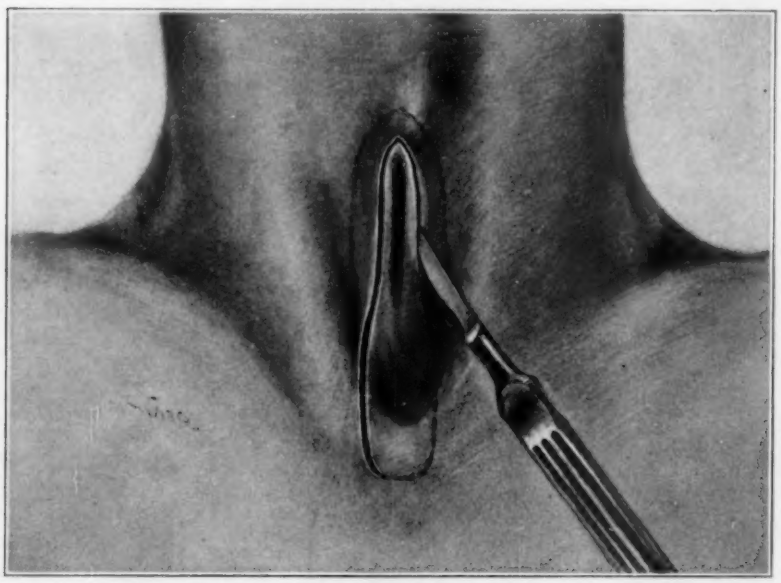


Fig. 2.—Outlining of flap. Dotted lines indicate the area to be undercut.

or iodin, as the dropping of any irritating solution into the trachea produces violent paroxysms of coughing.

Any hair existing on the surface of the flap should be destroyed by roentgen ray previous to operation.

The method of operation employed consists in raising a skin flap with its base attached to the lower end of the laryngostomic fissure (Fig. 2). The width of this flap is outlined in such a manner that the upward prolongation of the incision around the opening is not less than 6 mm. from the edge of the opening. This is a very important point, because if too narrow a flap is cut and the incised edge, which is afterward undercut laterally, as shown by the dotted lines on Figure 2, is made too close to the edge of the opening, the mucous membrane which lines the air passage will have retracted to such an extent that introduction of the sutures will be a difficult matter.

The length of the flap downward passes beyond the insertion of the tendinous portion of the sternocleidomastoid muscle and at times extends over the manubrium. The width of the flap should be almost the same at the top as at the base, and the flap should not be made pointed. Measure the length of the fissure and add one-third to this measurement to allow for shrinkage. The width of the flap should be 2.5 cm. as a rule, although it may be as narrow as 2 cm. Skin and underlying fat are lifted in one piece, and the lower end of the flap later corresponds to the upper end of the laryngostomic opening. Ascertain that the flap is sufficiently long to lie perfectly loose over the opening without tension. The area is undercut laterally along the sides of the opening and above it so that the

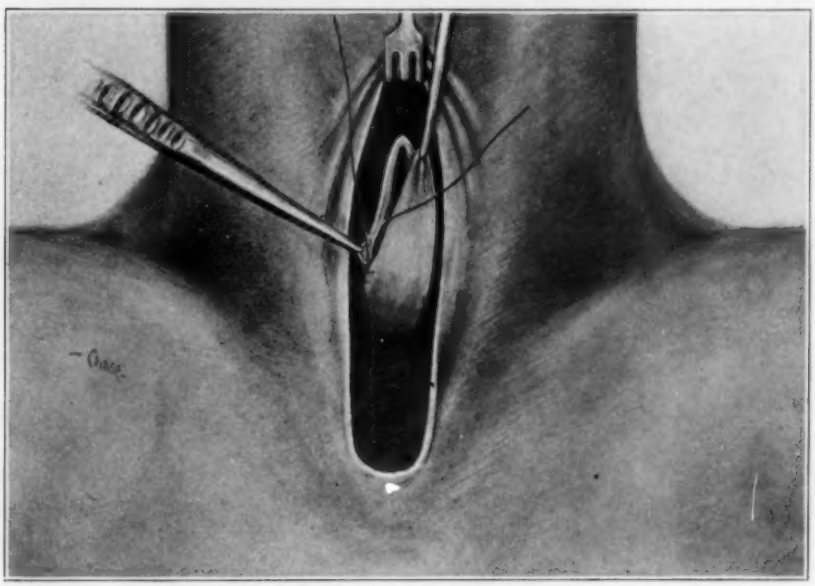


Fig. 3.—Flap turned up and method of suturing.

remaining skin of the neck can be brought together in the median line over the flap. The upturned flap is then sutured to the edge of the lining of the opening in such a way that the sutures are invisible from the outside when they are tied and that the knots will lie on the inside of the air passage (Fig. 3).

This method of tying the knots is analogous to the end-to-end suture of the small bowel by the Connell method of using interrupted mattress sutures, or to the repair of a complete tear of the perineum in which the sutures are tied on the inside of the bowel.

The first suture is introduced at 3 mm. from the point of the folding of the flap at its base against the edge of the lining of the area. This suture, its fellow of the opposite side, and the last three deep sutures

used in the operation are the most difficult to insert and tie. The needle is introduced slightly less than 3 mm. from the edge of the skin flap, at the point at which it is folded up over the opening, from within outward and then reintroduced from without inward; this brings the knot on the inside.

After inserting and tying two or three sutures on one side, the next two or three sutures should be placed on the opposite side of the flap, proceeding from the base to the tip of the flap. This method will keep the flap straightened out in the position in which it will ultimately lie. In inserting and tying these sutures, care must be used to bring

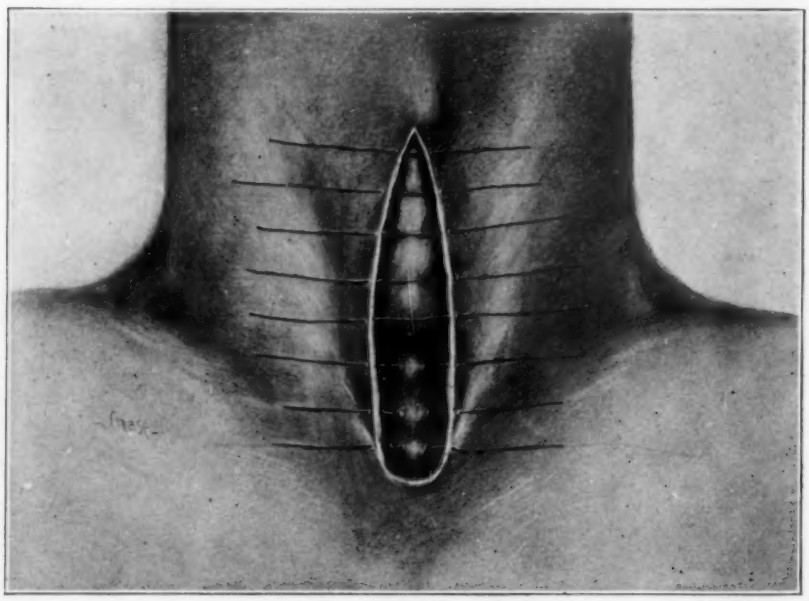


Fig. 4.—Flap completely sutured and superficial wound ready for closure.

the skin edge of the flap into perfect epithelial contact with the edge of the opening. The space between sutures should be less than 3 mm.

As the suture lines approach completion, a little opening is left at the upper end, and sharp scissors should be used to cut off the slightly redundant tip of the flap. This does away with too long a flap and reduces the possibility of gangrene from lack of circulation, and, even if it were not necessary for that reason, is a wise procedure, because it obviates the utilization of tissue that has been held by forceps and possibly devitalized.

The final problem is that of closing a small tube. The last three or four sutures are left untied until all the sutures are introduced. One interrupted suture running from the fat on the top of the flap to the

tissues up and beyond the last point of suture will give added security. Interrupted silkworm-gut sutures close the skin wound (Fig. 4). One should be careful not to make too perfect a closure, because there may be some infection of the wound and easy exit for secretion should be provided in advance. As the space between the sternocleidomastoid tendons is unyielding, and as the obliteration of a dead space is difficult, a small drain should be introduced at this point.

Ordinary black spool silk, size A, is used for the deep sutures. Catgut should never be used, because the large number of sutures of catgut would make a bulky mass of foreign matter which might prove to be decidedly detrimental. The best needle is a milliner's straw needle, No. 9, sharps; it may be necessary to use a very fine curved needle if the skin has been cut too close to the opening, on account of the retraction of tissue.

COMMENT

The principle on which the success of this operation depends is the security with which the flap is held by the nonabsorbable sutures. The ultimate fate of these sutures need cause no anxiety; they are cast off into the trachea and larynx during the course of healing.

Successful closure depends also on anticipation of infection. Operation is carried out under extreme difficulties in the observance of thorough antisepsis. Three of our patients developed some wound infection. On the appearance of inflammation, hot boric acid compresses are used over a period of twenty-four to forty-eight hours. This treatment saves these wounds from a complete breakdown in the same way that it saves abdominal wounds that are on the verge of infection, as recommended by Watkins, of Chicago. Even if the wound should be very red or should be discharging between the sutures, the skin sutures should never under any circumstances be removed.

CONCLUSIONS

The trifling infection in our patients had no bearing on the final result. Six of the patients in the series were referred to me by Dr. Jackson. Five of these patients made complete and permanent recoveries. A second tracheotomy was performed by Dr. Louis H. Clerf on the sixth patient, on account of scar contraction within the larynx. This contraction occurred six months after the obliteration of the fissure and was not the result of the closure of the laryngostomic fistula. The seventh patient, a lad, aged 11, who was referred to me from the service of Dr. Fielding O. Lewis, had primary healing and all skin sutures had been removed, when, on the eighth day after operation, after having been up and around the ward and apparently in perfect health, he died in a few moments, of edema of the lungs, probably attributable to cardiac disease.

1710 Locust Street.

"FRACTIONAL FATIGUE" OF THE OLFACTORY APPARATUS *

ARTHUR W. PROETZ, M.D.
ST. LOUIS

Two obstacles which confront the student of the olfactory function are, strangely enough, the complexity of the central apparatus and the simplicity of the end-organ. The anatomy of the first cranial nerve and its central tracts and pathways has been minutely described. Concerning their separate functions—if indeed these structures have separate functions—which in the aggregate produce those mental impressions which we interpret as smell, we are in total ignorance.

Tedious and inconclusive experiments were at one time performed on animals, in an attempt to fasten certain smell impressions on given tracts and centers, but the results were so uncertain as to be of little value.

Although the central apparatus consists of a score of nuclei, tracts and fasciculi, which is hardly surprising when one takes into account the complexity of smell impressions, still the peripheral organ in the nose, which records these impressions, is bafflingly simple. Unlike the perception apparatuses of the eye and the ear, the specific sensory epithelium in the nose is extremely primitive. The olfactory cell is a simple, elongated, fusiform, neuro-epithelial cell supported by columnar, nonciliated and epithelial cells. The cytoplasm of the latter usually, though not invariably, contains a yellow pigment.

Considering the great delicacy of the sense of smell (man, though a microsmatic animal, distinguishes 6 or 8 parts in a million), the infinite variety of impressions which it differentiates and the complexity of its central pathways, one must be impressed by the possibilities it should afford for diagnosis. If the functions of the individual tracts were understood, what a material aid this knowledge would offer in localizing central lesions.

Three years ago I began a study of this problem, not unconscious of its difficulties, but encouraged by an observation, made by Read [1] in 1908, that the terminal fibers in the nasal mucous membrane, supposed until then to form a plexus, were in reality not a plexus at all but a closely interwoven mass of individual and discrete neurons proceeding separately to their terminations in the olfactory bulb. This appeared to open up at least the possibility of diversity of function extending into the end-organ. While at first glance this appears unlikely, it is nevertheless a starting point for investigation.

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* From the Department of Otolaryngology, Washington University School of Medicine.

* Read before the American Laryngological Society, Washington, D. C., May, 1925.

1. Read, Effie A.: Contributions to the Knowledge of the Olfactory Apparatus in Dog, Cat, and Man, Am. J. Anat. **8**:17 (May) 1908.

METHOD

The first requisite in the study of the problem was a definite system of taking and recording observations of olfactory acuity, both qualitative and quantitative. As existing tests proved inadequate, it was necessary to devise some system of exact olfactometry, by which qualitative and quantitative tests could be made and accurately recorded. This method is the subject of a previous contribution.[2] Briefly, the apparatus consists of a collection of 100 bottles containing odorous solutions, which the patient is given to smell, under controlled conditions. These are arranged in ten rows, ten bottles in a row. Each row represents one test substance; each bottle in the row, a different concentration of that substance.

Accepting the probability that odor is directly or indirectly based on the chemical composition of the odorivector, the test substances were classified according to their chemical groupings, the simplest, chemically, in the first row, the most complex in the tenth row. Certain requisites were essential, such as solubility in oil to prevent evaporation, and other characteristics of a purely practical nature, considered particularly for the purpose of maintaining standard solutions over a period of time.

By experimenting with accurately and finely graduated concentrations of these substances on several hundred apparently normal noses, a minimum perceptible concentration was determined for each of the substances. This concentration was arbitrarily termed "one olfact," and was expressed in grams per liter—the substance and the solvent being stated in each case thus: 1 phenol-petrolatum olfact = 0.01921 gm. Two, three, four olfacts, and so on, represent two, three and four times this number of grams per liter. This expression of olfacts in grams per liter was adhered to, in spite of some apparent discrepancies in the progression of smell intensity, because it offered the only available, definitely mensurable comparison. The table shows the list of test substances employed in the olfactometer, together with the value of one olfact in each case.

List of Test Substances

Solutions	Gm. Per Liter
Iodoform	0.00250
Methyl Salicylate	0.00297
Amyl Alcohol	0.00275
Xylene	0.01730
Nitrobenzine	0.03050
Phenol	0.01921
Guaiacol	0.00302
Cinnamon	0.00106
Eugenol	0.00053
Coumarin	0.00077

The appended chart for conveniently recording observations, has been devised since the publication of the method. This constituted the first step in the investigation. Brain lesions involving the olfactory

2. Proetz, Arthur W.: A System of Exact Olfactometry, Ann. Otol., Rhinol. & Laryngol. **33**:746 (Sept.) 1924.

areas are rare, and considerably more data will be required than have been collected at the present time, before actual localizing can be accomplished.

SMELL COMPLEX

The next problem which arose is fundamental: Can olfactory impressions be separated for purposes of study, in such a manner that various odors may be employed to test individually the functional acuity of tracts involved? In other words, can we demonstrate physiologically that the tracts which have been mapped out by the anatomists play separate and distinct parts in the smell complex?

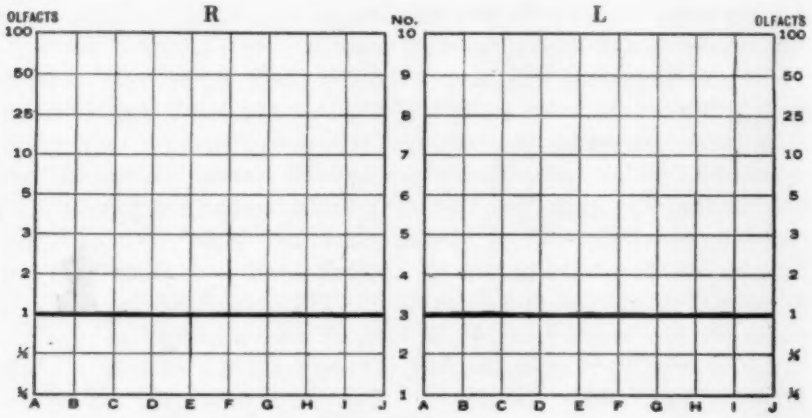
OLFACTOMETRIC CHART

Age Ref.

Preop. Diag:

Postop: Diag:

Note:



Observation Chart

Obviously, it is impossible to block certain of the peripheral fibers of the olfactory nerve by ordinary means without blocking the remainder. The failure of picking out certain central pathways for destruction in animals has been mentioned. Still, it seemed of the utmost importance to demonstrate, before attempting any differentiating tests, that the whole smell apparatus from beginning to end is not concerned with each and every smell impression.

After some useless and discouraging experiments along other lines, the idea of utilizing well known fatigue phenomena for this purpose finally occurred to me.

FATIGUE PHENOMENA

It was observed long ago that the olfactive apparatus, at least in man, is peculiarly prone to fatigue. Zwaardemaker,[3] by whom few

3. Zwaardemaker, H.: Physiologie des Geruches, Leipzig, 1895.

phases of the physiology of smell were overlooked, plotted fatigue curves (Ermüdungs-curven) for several odors. He and others regarded odors as having "specific energies."

In the use of the olfactometer also, this tendency to fatigue is strikingly apparent. One fact, however, is clear: That fatigue to one odor does not impair acuity to other odors.

The following experiment was accordingly performed: Two solutions were prepared in suitable wide mouthed bottles. The first was a strong solution of an odorous substance, *A*. The second was a similar solution of *A*, to which a small amount of a second test substance, *B*, was added. The proportion was such that *A* in the solution completely overpowered *B*, which could not be detected by smelling. Accordingly, both bottles smelled wholly of *A* although the second bottle contained some *B*.

The first bottle (pure *A*) was applied to the nose and smelled for three to eight minutes, in order to fatigue the nerves to odor *A*.

It was found at the end of this time that when the second bottle was again smelled, the odor of *B* was quite apparent, in a few instances approaching *A* in intensity.

This appears to strengthen a small but important observation, namely, that in some way the smell apparatus deals separately with various odors. Whether certain tracts become fatigued or whether specific components of the olfactory pigment cells become exhausted, we do not know. Supporters of the "undulatory theory," which credits the pigment with a large part in the smell function, will adhere to the latter view. Until the exact nature of olfaction is understood, the causes of the fatigue phenomena must remain a mystery. What concerns us here, however, is the fact that certain elements of the smell apparatus can be physiologically separated from other elements.

It has been noted that the experiment may be reversed by interchanging the concentrations of *A* and *B*, using *B* as the exhaustor.

Furthermore, the phenomenon is much more pronounced with some substances than with others, among the former being aromatic volatile oils, such as peppermint, anise, clove and cinnamon. It can be produced as well by tasting the solutions (gustatory odors). Thus far, attempts to determine optimum concentrations and combinations have failed, as they vary widely between persons and at different times in the same person.

COMMENT

Abstractly, these observations of "fractional fatigue," if one may coin that term, are unimportant, and, so far, they have been unproductive of practical results. They are presented, however, as stepping stones along a seldom trodden path on which our foothold at best is none too secure.

Clinical Notes

CONTROL OF PAIN THROUGH THE NASAL (SPHENOPALATINE) GANGLION

REPORT OF CASES OF HERPES ZOSTER OF THE OPHTHALMIC NERVE AND OF THE BRACHIAL PLEXUS *

CHARLES LUDVEY DAVIS, M.D.
ST. LOUIS

CASE 1.—C. G., aged 74, a fireman, was referred to me, July 14, 1924, because of pain and nasal findings in herpes zoster of the supra-orbital and the frontal branches of the ophthalmic division of the fifth nerve.

On examination of patient, I found a marked herpetic eruption along the distribution of the frontal and the supra-orbital nerves. The patient was suffering from severe pain and from a sense of burning above the left eye and along the distribution of the frontal nerve, together with a severe unilateral frontal type headache. There was marked conjunctivitis and keratitis, but no pain in the eyeball. He had had asthma for twenty years.

The vestibules of the nose were negative, the mucous membrane was slightly congested giving the appearance of a subacute rhinitis on the left side; the general condition of the membrane all over the nasal cavity was atrophic; there was pus in the middle meatus anteriorly on the left side, and also in the spheno-ethmoidal recesses posteriorly on both sides.

I thought that the pain might be relieved by a nasal (sphenopalatine) ganglion block and applied saturated cocain to the region of the sphenopalatine foramen for fifteen minutes; this application failed completely to give relief. An application with saturated cocain solution was then placed in the uppermost anterior limit of the nose in which the anterior ethmoidal nerve enters, and was allowed to remain for ten minutes. It relieved the headache and the pain of the herpes completely.

This procedure was repeated on three consecutive days with longer relief each time. On the fourth day cocainization was not necessary as the patient did not complain of headaches. Only a slight itching along the course of the nerves remained.

COMMENT

The result of the nasal ganglion block for relief of pain in this case was identical with the results obtained by Bryan[1] in the case he reported. Results have been obtained by Sluder[2] by the nasal ganglion block and described by him. Relief of pain in the ears secondary to cancer of the larynx is reported in two cases by Clerf.[3] Relief of pain from tuberculous laryngitis is reported by Gundrum.[4]

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* From the Laryngological Department of the Washington University School of Medicine.

1. Bryan, W. M. C.: The Control of the Pain of Herpes Zoster of the Nervous Ophthalmiaces Through the Nasal Ganglion and Through the Sphenoid Sinus, Laryngoscope **33**:703 (Sept.) 1923.

2. Sluder, Greenfield: Concerning Some Headaches and Eye Disorders of Nasal Origin, St. Louis: C. V. Mosby Company, 1918.

3. Clerf, L. H.: Control Through the Nasal Ganglion, of Earache of Laryngeal Origin, J. A. M. A. **82**:630 (Feb. 23) 1924.

4. Gundrum, L. K.: Pain from Tuberculous Laryngitis Relieved by Cocainization of the Nasal (Sphenopalatine, Meckel's) Ganglion, J. A. M. A. **83**:998 (Sept. 27) 1924.

I was unable to apply cocain in the sphenoidal cavity so as to block the first division of the fifth nerve. Nasal treatment of the sinuses has been carried out and the asthma has been much relieved.

This case is of interest as a demonstration of relief of the pain in the distribution of one branch of the trigeminus nerve by cocainization of another branch at rest. At present, this phenomenon cannot be explained.

CASE 2.—The patient, referred to the Nose and Throat Clinic from the Dermatological Clinic, was suffering from herpes zoster along the sterno-cleidomastoid muscle, the shoulder and the upper part of the arm. He had been suffering with severe pain for twenty hours without any sleep. The nasal findings were negative. Cocainization of the region of the sphenopalatine foramen for fifteen minutes gave relief of pain from the herpes zoster. Unfortunately, this patient did not return to the clinic for further treatment or observation. This case is reported as no similar observation has been made. Many inexplicable phenomena have been reported in relation to or concerning the nasal ganglion.

3519 Washington Avenue.

A NEW ENDOSCOPE FOR CLOSING SAFETY-PINS

A. J. SHEKTER, M.D., JAMAICA, LONG ISLAND

One of the many difficult problems the bronchoscopist encounters in his work is the extraction of the open, "point up" safety-pin in the child's esophagus or trachea. With all due respect to the instruments already devised for that purpose, I believe I have demonstrated successfully at Dr. Forbes Bronchoscopic Clinic at the Post-Graduate Hospital, New York, to the satisfaction of Dr. Forbes and his staff, the ease with which this one difficult problem can be solved by the use of the instrument here presented.

When the ordinary straight tube is used, and the Mosher-Jackson safety-pin closer is passed through this, the loop is entirely outside the line of sight when an attempt is made to bring it into direct line with the spring coil of the pin; hence, when the prong is also passed through the tube, in order to push the pin through the loop, it becomes almost impossible to see the pin and to work with safety, especially so when a small tube has to be used. This method makes it difficult and in some cases fatal, except in the hands of a skilled operator.

Because of the difficulties encountered, a newer tube has been devised, namely, the Mosher-Jackson trap door tube. Here an attempt is made to do away with the safety-pin closing loop. With a tube slit on one side the idea is to manipulate it in such a way that the pointed arm of the pin is slid through the trap door of the tube, which is then turned around so that its walls protect the point of the pin. Here also one can readily see the difficulties to be encountered when a small tube has to be used; the grasping forceps passed through this small tube obstructs the view and the withdrawal of a tube with an outside projecting arm is also a handicap.

The endoscope I am presenting is simple in its construction, requires but one additional instrument, the prong, besides the tube. This means very little interference with the line of sight, so important for accuracy of manipulation. I believe the illustrations will explain more fully. The instrument will be made up in two models: the one used for closing a pin in the esophagus is fashioned after Dr. Henry Forbes' tube, an oval tube permitting more room for manipulation in the tube, and a larger loop for closing the pin, also causing less pressure on the trachea when the tube is introduced; and a round tube fashioned after Dr. Chevalier Jackson's bronchoscope, which is constructed in several sizes, the smallest equal to a No. 4 tube.

As illustrated in Figure 1, the instrument, made of a steel tube, is either oval or round and is slit up on both sides at its distal end for about 1.5 inch, thus dividing this end of the tube into two blades, an upper and a lower one. Into the distal end of one of the blades is incorporated a hinged steel loop (*a*). By means of a flat steel rod connected with the loop at one end (*a*), and a thumb screw at the other, which screws into the proximal end of the tube (*b*),

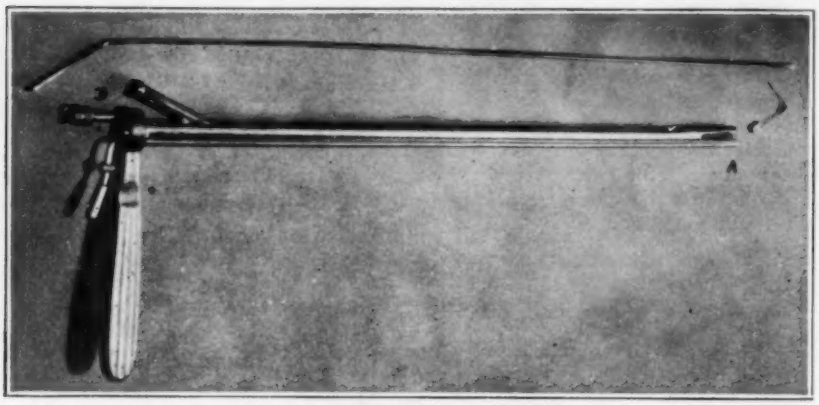

Fig. 1.—Safety-pin closing endoscope and prong.

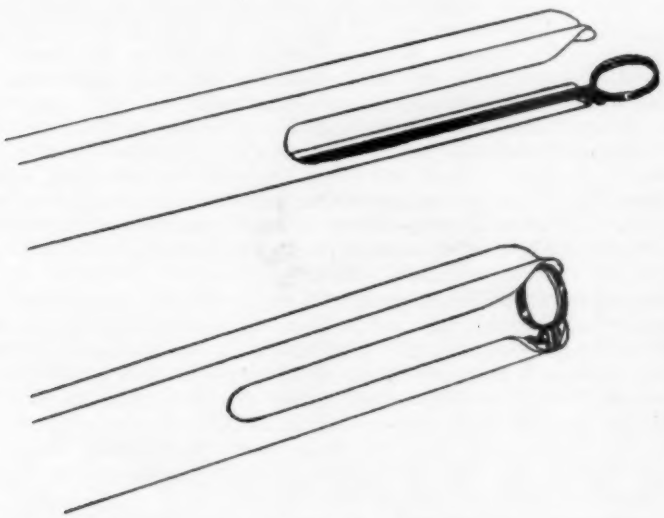

Fig. 2.—Hinged loop drawn down, distal end, *a*, of Figure 1 (upper figure); hinged loop drawn up (lower figure).

the loop can thus be either drawn up and fixed or lowered (Fig. 2), and whether drawn up or lowered remains in direct line of vision. The procedure in closing a pin is to introduce the endoscope with the loop drawn up (Fig. 1); this serves two purposes: (1) It is thus easier to pass the cricopharyngeus muscle or the cords; (2) it reinforces the two blades of the instrument while passing these parts. Now, having passed these parts, the loop is then drawn

down and the pin sighted. In sighting, look for the spring coil of the pin; having found this, direct and push the tube toward this spring coil, permitting the two arms of the pin to slide between both blades of the instrument, as shown in Figure 3; the loop is now drawn up by turning the thumb screw *b* and manipulating the tube in such manner that the coil of the pin fits into the loop. During all this manipulation only one instrument (the tube) thus far has been used, the only instrument introduced into the tube now is the prong. By carefully engaging the prong with the coil end of the safety pin, this is then

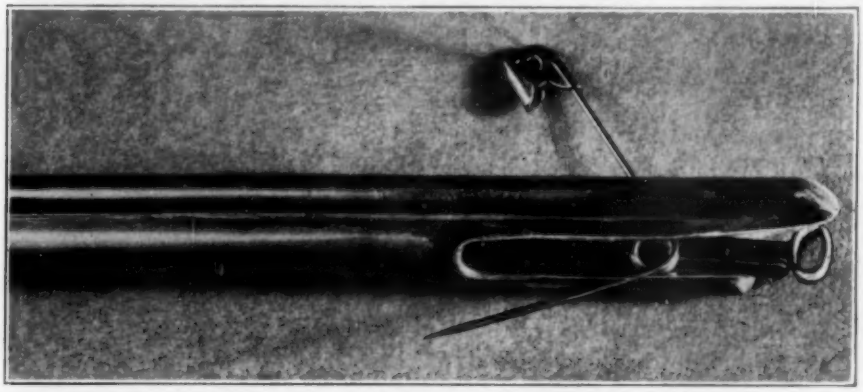

Fig. 3.—Pin riding between both blades of instrument.

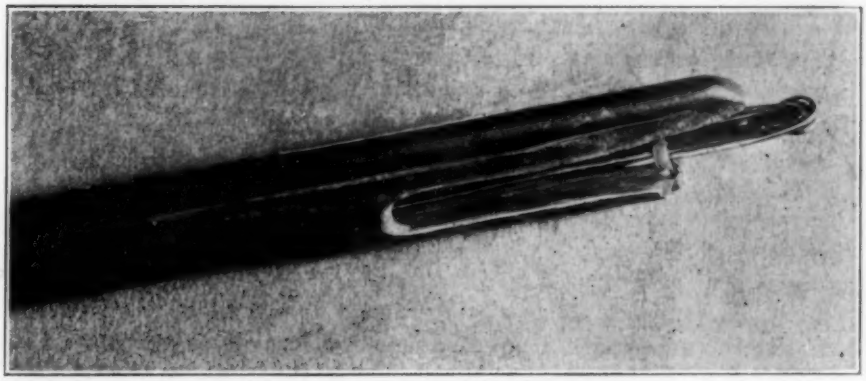

Fig. 4.—Loop drawn up and coil of pin pushed through loop and closed.

gently but firmly pushed through the loop (Fig. 4), and the safety pin in closing draws both its arms into the tube. Tube, pin and prong are then withdrawn with no damage to the surrounding tissues.

The instrument seen in Figure 1 is the original model, which is now being modified. The principle of the instrument will remain the same but there will be a much simpler loop closing mechanism; the loop will be the size of the lumen of the tube. This will permit an entirely free tube in which to work.

I am sure this instrument will be of value to the endoscopist.

150 Eighty-eighth Avenue.

PROGRESS IN OTOLARYNGOLOGY

A Summary of the Bibliographic Material Available in the Field of Otolaryngology

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OTOSCLEROSIS

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Otosclerosis is a condition characterized by bony changes involving the labyrinth capsule and leading in many cases to fixation of the stapes in the oval window. Broadly speaking, the change is one in which the dense bone of the normal labyrinth capsule is transformed into swollen vascular osteoid tissue which encroaches on the annular ligament and footplate of the stapes leading to ankylosis. This new vascular bone is sharply defined from the normal bone and stains deeply with basic dyes. It is confined to localized areas, the most usual site being the promontory between the two windows. This region is one in which vessels enter the labyrinth wall and in which cartilage "rests" are frequently found in early life, besides being subjected to stresses not felt by other parts. Foci are found in other parts of the labyrinth capsule remote from the mucosa and even in the internal auditory meatus. While there is a more or less general agreement as to what can be seen microscopically, its interpretation has given rise to considerable difference of opinion. Manasse[1] has described a younger part near the presumably advancing edge of the focus in which the bone stains very deeply with hematoxylin. The marrow spaces are large and are full of cellular elements, with here and there giant osteoclasts. The edge of the pathologic bone, however, is free from cells of all kinds. In the central parts of the focus the bone loses its special affinity for hematoxylin, and the marrow spaces are smaller and contain few cells. There is a gradual deposition of lamellar bone on the edges of the spaces, so that the oldest parts are sclerotic and rather similar to normal skeletal bone. In several cases in which there had been severe deafness, no ankylosis of the stapes was found. In all the old-standing cases there was decided atrophy of the nerve elements of the inner ear. Manasse was of the opinion that the normal bone was absorbed by pressure of the new mass without the help of osteoclasts. Mayer,[2] in a recent communication, disputes

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1. Manasse: Die Ostitis chronica metaplastica d. menschl. Labyrinthkaprels., Wiesbaden, 1912.
2. Mayer, O.: Ztschr. f. Hals-, Nasen- u. Ohrenh. (Oct.) 1924.

Manasse's view that the bone is passively absorbed through the pressure of the advancing mass.

Döderlein,[3] using special staining methods, interprets the changes differently. The first change seen is that the bone stains irregularly in a certain area: parts are deeply stained whereas neighboring parts are pale. Under high power magnification it is seen that the bone is divided up by wavy black lines into small distinct areas. The bone corpuscles, which normally stain black and show their radiating processes well, lose their sharpness of outline, become pale and swollen, lose their processes and finally disappear altogether. At the same time the surrounding bone loses its lamellar structure, stains more deeply, and is converted into a horny granular mass. These changes go on in immediate contact with areas of bone showing normal characteristics. It is a reasonable inference from the presence of the cracks that the horny degenerated areas have become softened. This bone change seems to begin around the vessels, and in these areas the bone stains deeply with hematoxylin. Manasse first pointed this out and referred to it as "mantle" formation, but thought it was new bone. According to Döderlein, thionin stain alone enables one to distinguish new from old bone, and at this stage there is no evidence anywhere of the formation of new bone. Somewhat later in the process, pictures are seen in which there are trabeculae of osteoid tissue enclosing spaces containing marrow cells and horny masses. When the focus happens to be near the surface of the bone, this osteoid tissue projects beyond the normal bone, and it is, therefore, apparently soft and partially decalcified, since only softened tissue can swell. Later, in the structureless horny masses signs of new bone formation appear. Bone cells again make their appearance with some surrounding osteoid tissue which forms trabeculae; these grow from the deposition of new layers and encroach on the marrow spaces. Later, the trabeculae forming this new network of bone gradually shrink and at the same time begin to stain like normal bone. The marrow spaces are now larger and are almost free from cells. The final stage is completed by a deposit of fresh layers on the trabeculae leading to the formation of dense compact bone.

Döderlein concludes:

> Shortly summarized, my researches show the otosclerotic bone changes as a locally occurring softening and absorption of the bone without participation of osteoclasts, and replacement through new-formed bone, which remains for a very long time in an incomplete stage of osteoid tissue and only later shrinks and become calcified. The newly formed spongy bone can gradually become compact bone.

3. Döderlein, A.: Ztschr. f. Ohrenh. **6**:477, 1923.

ETIOLOGY

Heredity is a striking feature of the disease. Bezold [4] has traced a family history of otosclerosis in 52 per cent. of his cases. Hammerschlag [5] regards otosclerosis, progressive nerve deafness and hereditary deaf-mutism as differing manifestations of the same disease. Gray [6] has also emphasized the tendency for the disease to run in families. More recently, Gradenigo,[7] in studying the family trees of more than 500 patients, found that it is transmitted along mendelian lines as a recessive characteristic. It is found in females more frequently than in males and in a more severe form. The symptoms appear on the average between the ages of 16 and 20 years. He states that there is a strict correlation with another hereditary condition, namely, adenoidism. Syphilis and tuberculosis increase its severity.

Katz,[8] Alexander,[9] and others, regard it as a low-grade inflammatory change, since very similar appearances may be found in chronic middle ear suppuration. Fraser [10] has pointed out also that the bone changes seen in congenital syphilis of the ear are quite similar. Gray,[11] on the other hand, from the absence of round-celled infiltration and the presence of a line of demarcation, thinks that the condition is not inflammatory. He looks on it as a degenerative process involving not only the bone but also other structures connected with the ear. Katz, Habermann, Alexander, Fraser and others believe the inflammatory condition begins in the mucoperiosteum of the middle ear. Politzer, on the other hand, after finding foci in the bone remote from the mucous membrane, concluded that the mucous membrane was not the starting point. According to Fraser, the fact that the foci are not always on the promontory but may be found in distant areas does not exclude infection from the mucous membrane, as in young subjects there is a lymph space extending round the labyrinth between the cartilaginous and the periosteal bone. He has also found foci of otosclerosis in subjects suffering from chronic middle ear suppuration and believes that infection from the mucosa plays some part in its origin.

The resemblance between the bony changes in rickets, osteomalacia and osteitis deformans has frequently been noted. Döderlein finds that by using von Recklinghausen's staining technic the changes in

4. Bezold: Ztschr. f. Ohrenh. **26.**
5. Hammerschlag: Monatschr. f. Ohrenh. 229, 1910.
6. Gray: Otosclerosis, London, 1917.
7. Gradenigo, G.: Riforma med. **40**:769 (Aug. 18) 1924.
8. Katz: Arch. f. Ohrenh. **68.**
9. Alexander: Arch. f. Ohrenh. **78.**
10. Fraser, J. S.: J. Laryngol., Rhinol. & Otol. **32**:8 (Jan.) 1917.
11. Gray: Otosclerosis, 1917, p. 148.

otosclerosis are identical with those found by von Recklinghausen in rickets and osteomalacia. He thinks that otosclerosis is a very similar process.

Jenkins [12] finds many points of resemblance between otosclerosis and osteitis deformans; both conditions show spongification of the bone. In osteitis deformans the trabeculae are thicker and the lamellae more distinct than in otosclerosis. Otosclerosis is localized and has a sharply defined edge, but the other condition has not. Osteoclasts are numerous in both but more so in otosclerosis. In his two patients with osteitis, the stapes was not ankylosed. In all patients with osteitis in whom the skull is involved there is deafness. There is no hereditary tendency in osteitis and it is found only in the aged, but otosclerosis is found in the young. Recently Kaufmann [13] reports on the changes in the temporal bone as the result of experimentally produced rickets in white rats. The changes found in the temporal bone were similar to those found in the long bones and identical with those found in otosclerosis. He states that otosclerosis may be regarded as a late sequel of rickets due to a deficiency of vitamin A.

Manasse says:

> To me, as already stated, any local cause for this disease is absolutely inconceivable. Everything points with the greatest probability to the cause lying in a general or constitutional disorder.

Mayer [14] looks on the condition as one of hyperostosis of the labyrinth bone, causing a closure of the round and oval windows. He thinks that it is a congenital malformation, such as a tendency to exostoses, which runs in families. The cause is still unknown. He does not see any resemblance to rickets or osteomalacia, but he does see some resemblance to osteitis deformans.

The ductless glands have also been blamed as the cause of otosclerosis, and Delie [15] considers the disease a developmental fault in the capsule caused by an error in its blood supply which is controlled by the cervical sympathetic, and is therefore influenced by the ductless glands. He asserts that otosclerotic patients show some hypothyroidism such as dry skin, calm temperament and dull mentality.

The disease is much commoner in the female sex than in the male. Fraser [16] mentions that out of a series of 713 cases, 537 were females and 176 males, that is, females preponderated in a ratio of about 3 to 1. Of Gray's patients, sixty-nine were women and twenty-six were men.

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12. Jenkins, G. J.: J. Laryngol. & Otol. **38**:344 (July) 1923; abstr., Proc. Roy. Soc. Med. (Sect. Otol.) **16**:21 (May) 1923.
13. Kaufmann: Monatschr. f. Ohrenh. **10.**
14. Mayer, O.: Wien. klin. Wchnschr. **37**:131 (Feb. 7) 1924.
15. Delie: Ann. d. mal. de l'oreille, du larynx, etc. (May) 1923.
16. Fraser: Laryngoscope (Dec.) 1923.

The symptoms are too well known to need elaboration. They are, in the main, gradually increasing deafness and tinnitus with not infrequently paracusis willisiana. The ear drums may be normal or may show a pinkish shimmer shining through from the promontory. On the other hand, otosclerosis does not exclude the presence of other pathologic conditions in the ear and therefore there may be thickening, scars or even a discharging perforation. With regard to functional tests, Bezold's triad of symptoms is generally regarded as typical. They are: (1) raising of the lower tone limit, (2) increased bone conduction relatively to the normal, and (3) negative Rinné test. In addition, Gelle's test is frequently negative. Fraser believes that the presence of a vascular focus in the wall of the cochlea without ankylosis of the stapes is enough to account for the subjective noises and deafness.

TREATMENT

The number of remedies recommended for the disease points to the fact that none of them are altogether successful. Phosphorus, sodium iodid, mercury in various forms, extracts of ductless glands, to mention some of the internal remedies, have all been recommended. Among the local treatments, injection of fibrolysin, massage of the drum and ossicles and the application of blistering fluid to the drum have had their vogue. Roentgen-ray and radium treatments have been tried with results that, on the whole, are very disappointing. Recently Warwick [17] reported good results with roentgen-ray treatment which he attributed to radiating the pituitary. However, this has as yet to be confirmed.

In 1922, Schwerdtfeger [18] reported good results both with regard to hearing and to subjective noises from the use of panitrin (Acetyl-diethyl-amido-nitrite of papaverin). He was followed by Blau, Lederer and Kobrak, who also gave encouraging reports. The drug is supposed to produce an active hyperemia of the ear by acting on the smooth muscle fibers of the blood vessels. The technic recommended is to inject the drug under both the periosteum of the mastoid and the posterior wall of the auditory canal. Injections are given once a week on alternate sides. Half of 1 per cent. of procain without epinephrin must be injected first, as there is a good deal of pain. Recently, Barajas y de Vilches [19] reported the results of a series of injections which caused some improvement in early cases of otosclerosis but none in the old cases. Dobrzanski [20] also reported good results in

17. Warwick, H. L.: Texas State J. M. **20**:194 (July) 1924.
18. Schwerdtfeger: Arch. f. Ohrenh. **109**:115.
19. Barajas y de Vilches, J. M.: Rev. espan. de laringol. (May-June) 1924
20. Dobrzanski: Polska gas. lek. 16, 1924.

the treatment of subjective murmurs. On the other hand, Möller [21] made an extensive trial of panitrin, using Schwerdtfeger's technic, and came to the conclusion that it was absolutely worthless.

If the drug has a specific effect on the blood vessels of the middle and inner ear, it is somewhat difficult to understand why it should have to be injected behind the ear. It is inconceivable that any substance injected under the periosteum behind the ear could reach the inner ear or cochlear nerve, or even the region of the promontory. If its action is selective, a hypodermic injection anywhere else should do equally well. It appears that any results claimed may be reasonably attributed to a counter-irritant effect, plus a good deal of autosuggestion and psychic influence which goes with any new remedy, especially if it has been hailed as a panacea.

Higier [22] contributed an interesting article in which there was the report of a remarkable improvement in hearing in two patients with otosclerosis of long standing after a large overdose of arsenic. One was due to attempted suicide, and the other to accidental taking of rat poison.

DEAF-MUTISM

The inner ears of many subjects of deaf-mutism have been examined by Alexander, Siebenmann, Hammerschlag, Denker, Urbantschitch, Nager and Goerke and many classifications of the conditions found have been made. Two groups may be distinguished: (1) those due to developmental defects, and (2) those due to inflammatory conditions or traumatism. In the first group are those with faulty development of the middle ear such as is found in cretins. In another subdivision are those whose middle ear structures are normal but a part or the whole of the labyrinth is defective. The type described by Scheibe is one in which the cochlea alone is affected, while the vestibular structures are normal. In Alexander's type both vestibular and cochlear elements are affected.

The results of intra-uterine and extra-uterine labyrinthitis and meningitis fall into the second group. For a full account of the foregoing changes, the reader is referred to the work of Fraser.[23] Neumann [24] claimed to have described for the first time a case of congenital malformation of the cochlea with partially retained hearing. In his patient, a man with advanced pulmonary tuberculosis and chronic middle ear suppuration, both cochleae were much distorted.

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21. Möller: Beitr. z. Anat., Physiol., Path. u. Therap. d. Ohres. **21**:236 (Nov.) 1924.

22. Higier, H.: München. med. Wchnschr. **71**:370 (March 21) 1924.

23. Fraser, J. S.: J. Laryngol. & Otol. **37**:13 (Jan.) 1922; ibid., Ann. Otol., Rhinol. & Laryngol. **32**:953 (Dec.) 1923.

24. Neumann: Ztschr. f. Hals-, Nasen- u. Ohrenh. **3**:154, 1922.

On one side the modiolus was bent, and on both sides there were large gaps or communications between the scalae of the different coils. Corti's organ was found only here and there in a rudimentary form. There was also collapse of the cochlear duct.

Fraser [25] has described the microscopic appearances in a congenitally deaf white bull terrier, which corresponded to the type of Scheibe. The changes, briefly stated, are: collapse of the cochlear duct and saccule; adhesion of Reissner's membrane to the basilar membrane; Corti's organ represented by an irregular arrangement of cells; colloid bodies in the cochlear canal; membrana tectoria tucked into the internal spiral sulcus, and connective tissue in the cochlear aqueduct.

HEREDITARY DEAFNESS

Gradenigo [26] claims to have discovered a form of deafness not previously described. In it there is a complete loss of hearing in one or more well defined regions of the tonal scale, the rest of the scale being normal. He believes that the hearing power is not equal along the whole scale. If we measure the minimum energy necessary to produce a stimulus in the various segments of the scale, we find that much less energy is needed in the central part of the scale than at the two extremities. The most sensitive part of the scale ranges from *do* 4, that is, 2,000 double vibrations, to *sol* 3, that is, about 1,500 double vibrations. The auditory gaps and defects that we encounter clinically can be divided into two main groups: (1) those following destructive processes in certain parts of the cochlea, and (2) those that do not depend on an inflammatory cause but have a family degenerative character. The author deals more particularly with the second group. In all the cases of tone defects following cerebrospinal meningitis, the vestibular apparatus is more or less seriously damaged. This is an important symptom, differentiating it from the second group; we can recognize analogous conditions in congenital syphilis.

The hereditary degenerative type of tone defect is much rarer than the first group, in fact there are only four cases reported in the literature. In his long professional activity the author has met with twenty-eight subjects of progressive deafness belonging to twelve families, of which he had been able to examine nineteen. In the twenty-eight cases the familial character was manifest in twenty-two; the middle ear was normal in all. In the largest proportion of these subjects the upper part of the scale was lacking. The hearing, which was well preserved in the lower part of the scale, stopped sharply with a limit between 500 and 1,000 double vibrations. The hearing

25. Fraser: J. Laryngol., Rhinol. & Otol. (Feb.) 1924.

26. Gradenigo, G.: Nineteenth Congress of Italian Society of Laryngology and Otology, 1924.

was completely absent above this limit and in some other subjects there was a complete loss at the lower end of the scale as well. The functioning region was normal or almost normal. In the second group of cases there was a defect at the superior extremity of the scale in the ultramusical zone, that is, from 4,000 to 6,000 double vibrations. This is similar to the ordinary old-age deafness except that the defect extends lower down in the scale. In a third group there was a circumscribed gap between 1,500 and 3,000 double vibrations with the rest of the scale normal. There was a fourth group consisting of one case with a gap in the lower part between 48 and 192 double vibrations. In many of these subjects the tone scale appeared normal with the tuning forks, but with Stefanini's electrotelephonic acoumeter the gaps were easily discovered. Gradenigo also uses the church organ in testing the hearing. In all these patients the deafness was noted from the early years of life. In the families of the patients there were other persons with deafness, but they were generally of a different clinical type. Discussing the nature of the condition the author thinks it probable that there were lesions in the cochlear nuclei, and from the study of these patients he thinks also that there are at least five bundles of fibers in the cochlear nerve corresponding with different zones in the tone scale. He looks on the condition as analogous to the defects in vision in disseminated sclerosis.

OCCUPATIONAL NERVE DEAFNESS

That the hearing may be seriously impaired through exposure to loud noises has long been known, and the experiments of Wittmaack,[27] Yoshii [28] and others showed that prolonged exposure to sounds of a certain pitch produced degeneration of the organ of Corti in certain limited areas. A second series of experiments by Wittmaack [29] showed that not only air-conducted sounds but vibrations transmitted from the floor through the bones can also produce degeneration in the cochlea. The damage due to air-conducted sounds is induced fairly rapidly but remains stationary, that is, it does not extend progressively up and down the cochlea. The lesions due to floor vibrations, on the other hand, take much longer to produce but are steadily progressive. Kimura Motogora [30] repeated Yoshii's experiments on white mice and obtained the same results as Yoshii's on guinea-pigs.

Rodger,[31] in an investigation of boilermakers' deafness, showed that the deafness commenced in that part of the tone scale correspond-

27. Wittmaack, Ztschr. f. Ohrenh. **54**, 1907.
28. Yoshii: Ztschr. f. Ohrenh. **58**, 1909.
29. Wittmaack: Arch. f. Ohrenh. **102**:1-2, 1918.
30. Motogora: Ztschr. f. Hals-, Nasen- u. Ohrenh. 13, 1924.
31. Rodger: J. Laryngol., Otol. & Rhinol. (March) 1915.

ing with the prevailing noises, and that only later did the deafness spread up and down the scale. This was contrary to the generally accepted view that the impairment of hearing begins with the loss of the uppermost tones. Recently Tenaglia [32] has recorded his observations on occupational deafness in a series of workers in noisy trades. The first group consisted of twenty-five men who worked in a factory where large steel conduit pipes are made. There were two operations, the first curving the metal sheets in a rolling mill assisted by some hammering, and the second in riveting the edges with pneumatic hammers vibrating from 700 to 1,200 times a minute. The noise in the workshop was tremendous. The author became deaf in a few minutes in the riveting room and could not hear the voice of his guide. The noise from the rolling mill, while extremely loud, was of lower pitch than that of the riveting, which was lacerating and stupefying in its intensity. Some of the riveting was done from inside the cylinders, and the noise in this work was even more terrible than in the rest of the workshop. The work was in eight-hour shifts interrupted by two hours for dinner. At the end of each day the riveters were completely deafened and stupefied, but some of this passed off in a few hours.

In the examination the author excluded all who had any pathologic condition in the nose or throat. He examined twenty-five workmen; he tested them on coming to work in the morning and again at the end of their eight hours of work. In all of them bone conduction was shortened. In twenty-one Weber's test was indefinite, and in the rest it was referred to the better ear. Rinné's test was negative in six and positive in seventeen, though markedly shortened. The ticking of a watch was not heard at all by any workers who had been in the factory for several years. In others it was perceived, though very feebly. A low voice and Politzer's acoumeter were perceived in most subjects only immediately at the ear; in some they were not heard at all. In the examination with tuning forks there was a distinct diminution in the duration of perception of the whole series, with an accentuation for the high tones between the third and fourth octaves. The diminution was not uniform but irregular, and showed, here and there, gaps for certain tones. With the Galton whistle the upper tone limit was well preserved, except for a few who were advanced in years, in whom there was a slight lowering of the limit. The severity of the deafness was in direct relation to the length of service and the nature of the work, that of the riveters being the worst. After eight hours work there was a marked diminution in the duration of perception of the tuning forks, more especially in the younger workers and in those with fewer years of service. However, in those who had worked

32. Tenaglia: Arch. ital. di Otol. **35**:268 (Aug.) 1924.

for many years the difference between the morning and evening perception was insignificant.

Tenaglia also examined sixty textile workers. In this work there were 300 looms in action and there was a continual loud noise, the prevailing tone of which was rather low. The author noted a certain amount of deafness which disappeared soon after leaving the factory. In this occupation there was also an eight-hour day with a two-hour interruption. Examinations were made in all cases at the commencement of the day, and in a few in the evening as well, but no particular difference was noted between the two periods. In the functional tests normal results were found in all but about seventeen, in whom perception was somewhat reduced.

Five military telegraphists of four or five years' service were also examined, with normal findings.

Tenaglia states, on the authority of Gradenigo, that the first winding of the cochlea is by far the most delicate, and subject to degeneration in experimental work. This corresponds to the tone scale between *sol* [3] and *do*.[5] According to Gradenigo, also, the resonance tone of the external auditory canal is in the fourth octave, and therefore this will contribute to rendering the internal ear particularly sensitive to sounds of this pitch, and those sounds are the first which are badly perceived in occupational deafness. He concludes that in order to produce lesions in the internal ear like those of occupational deafness, that (1) the acoustic injury must be continuous and incessant for years so as to exhaust the resisting power of the organ; (2) there must be a special acute tone between the third and the fifth octaves corresponding to the zone of greater sensitiveness and vulnerability of the lamina spiralis of the cochlea. The low and the very acute tones are not those that damage the perceiving elements; (3) the sounds must be decidedly intense.

Numerous cases of lesions of the inner ear through explosion and gunshot wounds of the head were seen during the war, but even before then a number of observations had been made on the subject. Yoshii found hemorrhages in the middle and inner ear from detonations, as well as degeneration of parts of the organ of Corti. Hoessli [33] found similar changes, but on experimenting with explosives at some distance from the animal, no hemorrhages were produced, only degeneration of the organ of Corti. He also found that if there was perforation of the tympanic membrane or if the incus was removed, the lesions of the inner ear were lessened or absent. This agreed with the clinical experience of most observers during the war. Fraser [34] found hemorrhages in the middle ear and labyrinth, but in one subject in whom

33. Hoessli: Ztschr. f. Ohrenh., 1912.
34. Fraser, J. S.: J. Laryngol., Rhinol. & Otol. **32**:340 (Nov.) 1917.

there was a plug of wax no damage to the inner ear had occurred. Got [35] found that patients with previously normal ears were more apt to have labyrinthine lesions than those in whom the drum was ruptured at the time or in whom the middle ear was already defective. Uffenorde [36] has published a report of the microscopic findings in six cases of gunshot wound of the head and concussion deafness; in all except two the patients had intact drums. Blood was found in the middle ear in all, and in many there were small fractures which could only be seen with the microscope. There was hemorrhage into the inner ear in all cases and also into the internal auditory meatus. In some there was laceration of the nerves in places.

The severity of the inner ear lesions in concussion deafness varies directly with the force of the shock when the middle ear is normal and the drum is not ruptured. When the ear drum is ruptured, the inner ear does not receive the full force of the explosion and is not so severely damaged. The effects of concussion deafness may vary from slight deafness and tinnitus without any demonstrable lesion, to complete destruction of the inner ear from hemorrhages or injury to the organ of Corti as well as detachment of the otolith membranes.

MÉNIÈRE'S SYSTEM COMPLEX

With regard to Ménière's disease, McKenzie [37] had occasion to refer to the original description of Ménière's classical case. In order to find it he looked up Politzer's reference, which was the *Gazette Medicale de Paris,* 1861. On referring to this journal, it was found that the article in question was obviously not the first reference to the case. It was that of a girl who had been traveling at night in winter, on the outside of a coach in severe cold and at her menstrual period. She became suddenly completely deaf and was admitted to the hospital. The chief symptoms were continual vertigo and vomiting, and the patient died on the fifth day. Necropsy showed the brain to be absolutely normal, but on examination of the ears the sole lesion found was that the semicircular canals were filled with a red plastic material or sort of bloody exudate. There was hardly any of this in the vestibule and none in the cochlea.

After a fruitless search through the files of the *Gazette* back to 1848, attention was drawn to a German treatise on the diseases of the ear by Kramer, translated and annotated by P. Ménière in 1848. On page 397 is the original account and in it he states: "I found in the whole of the labyrinth a sort of reddish plastic lymph, which seemed the product of all the membranous surfaces lining the internal ear."

35. Got: Rev. de Laryngol. (Jan. 15) 1916.

36. Uffenorde: Beitr. z. Anat., Physiol., Path. u. Therap. d. Ohres. (Nov.) 1924.

37. McKenzie, D.: J. Laryngol. & Otol. **39**:446 (Aug.) 1924.

The two descriptions do not tally; in the original there was no mention of vertigo, and the whole of the labyrinth was said to be affected, while in the description written thirteen years later Ménière stated that the semicircular canals were the only parts affected, and that vertigo was one of the principal symptoms. He nowhere mentioned "apoplexy" or "hemorrhage."

LABYRINTHITIS

The pathology of labyrinthitis has been thoroughly worked out for some time. The infection may reach the labyrinth in three ways: (1) from the middle ear, (2) from the meninges and (3) from the blood stream.

The first route, namely, from the middle ear, is by far the most common. The infection may reach the labyrinth through the oval or round windows, through the external semicircular canal, the promontory, or through some other part in which the middle and inner ear spaces are in close contact. Numerous cases are on record in which the spread through the windows has been histologically proved. Leukocyte infiltration has been seen extending from the mucous membrane of the middle ear through a gap in the membrane of the round window, or through the annular ligament or the footplate of the stapes. A deposit of cells and coagulated lymph occurs on the walls of the labyrinth adjoining the portal of entry. In mild cases the lymph has few cells but as the process becomes more intense, more and more leukocytes are seen in it till it becomes pus. In the early stages of the inflammation the organ of Corti is normal or almost normal, but generally by the time the exudate in the perilymph spaces has become purulent, the hair cells have disappeared. The supporting cells may often be distinguished even after the spaces have become filled with granulations. The cochlear duct is generally somewhat collapsed and does not become filled with purulent exudate till some time after the perilymph spaces.

In other cases, generally associated with chronic middle ear suppuration and cholesteatoma, erosion of the external semicircular canal occurs. At a certain stage of the process the bony cap may be eroded while the endosteum and labyrinth itself are intact, and it is in those cases that the so-called fistula symptom is most commonly found. This symptom may, however, be found with erosions in other parts of the labyrinth capsule. This was generally supposed to be due to stimulation of the ampulla of the external canal. Recent work on the physiology of the otolith organs in the vestibule by Maxwell, Magnus, de Kleijn and others, has, however, indicated another possible explanation, and Mygind [38] in a paper on the mechanism of the fistula symptom

38. Mygind, S. H.: J. Laryngol. & Otol. **39**:498 (Sept.) 1924.

adduces evidence which suggests that the fistula symptom and the reversed fistula symptom are due to the otoliths and not to the ampullae.

In a further stage of the erosion the endosteum becomes infiltrated and a plastic exudate forms on its inner surface causing an obliteration of the canal, which may remain localized. In other cases, however, a sudden burst through occurs and the labyrinth is flooded with infected material causing a generalized labyrinthitis. A sudden rupture, of course, may occur through the windows or other situations with the same result.

Clinically, the subjects with slow invasion do not always show the classical symptoms of labyrinthitis. There may be very little dizziness, and nystagamus is only elicited on extreme deviation of the eyes. Deafness is absolute, but that may not be noticed as the patient is already quite deaf owing to the middle ear infection. Cases of sudden invasion of the labyrinth, on the other hand, whether through accidental injury or sudden extension of a morbid process, show violent symptoms such as vertigo, nausea, vomiting, nystagmus and disturbances of equilibrium.

When the labyrinth is filled or partially filled with pus, spontaneous drainage is generally poor, and meningitis may supervene through extension of the infection through the aqueduct of the cochlea or along the nerve sheaths. This happens most frequently in cases of sudden invasion before a plastic exudate has had time to seal off the communications with the meninges. The exudate becomes thicker and endothelial cells grow into it and commence to convert it into granulation tissue. After a variable time the pus is entirely replaced by granulations. This is followed by the appearance of osteoid tissue which becomes more and more consolidated till the whole labyrinth cavity may be entirely obliterated by new bone, and a spontaneous cure results. Recently, Hellmann [39] has studied this ossification in the inner ear and differentiates the process into two distinct varieties. In the first form, which is only found when there has been an erosion of the bony wall of the inner ear, new bone lamellae with numerous regularly arranged bone corpuscles are found. The new bone is almost indistinguishable from the old, except that it stains less deeply, has larger marrow spaces, and shows cement lines separating one lamellar system from another. The lamellae and blood vessels of the old and the new bone are continuous and the process is evidently due to osteoblast activity. The second or metaplastic form is different, in that there is a distinct line between the old and the new bone but no cement line. This type is formed through ossification of fibrous tissue in the labyrinth. There are no osteoblasts and there is no connection between the vessels of the old and the new bone.

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39. Hellmann: Ztschr. f. Hals-, Nasen- u. Ohrenh. **7**:1, 1923.

DEAFNESS IN TYPHOID FEVER

E. Schlittler [40] records the results of the microscopic examination of the temporal bones of a woman, aged 60, who died of typhoid fever. The hearing had been normal at the commencement of the illness but the patient became quite deaf before death. The diagnosis of otitis interna was made, but it was difficult to decide whether the otitis was of a metastatic or of a toxic nature. The histologic appearances excluded infection from the middle ear. The author thinks that the inflammatory process had spread to the inner ear from the meninges. In general, the changes are similar to the changes in the internal ear found in the other acute exanthems.

SYPHILITIC DISEASE OF THE EAR

Congenital syphilis is one of the most frequent causes of deaf-mutism, according to Fraser. This has generally been attributed to neuritis of the auditory nerve secondary to meningitis. Mayer [41] has demonstrated diffuse infiltration in the meninges and in the eighth nerve extending outward into the spiral ganglion. The infiltrate consisted mostly of small lymphocytes. There was some atrophy of the cells of the spiral ganglion also. Fraser has shown that in some cases of late congenital syphilitic deafness, otitis media is the starting point of the ear condition. From here it spreads into the marrow spaces of the petrous bone, gradually involving the labyrinth capsule and the labyrinth. Another form is sometimes seen in which there is a rapid invasion of the inner ear through the oval or round windows.

In the first class, that is, when there is gradual extension along the marrow spaces, the bone stains deeply with basic dyes and there is a condition of osteoporosis not unlike that found in otosclerosis. The walls of the labyrinth become greatly thinned before the inner ear itself becomes involved, and in this connection it is easily understood how a positive fistula symptom is often found, as was pointed out by Hennebert.[42] He found the symptom reversed, and attributed it to a thickening of the endolymph and adhesions between the bony walls and the membranous labyrinth. According to Fraser there is a secondary degenerative neuritis following the labyrinth involvement in those cases.

Recently, Spira [43] has found evidence of inner ear involvement in 19 per cent. of cases of untreated primary syphilis. There were subjective symptoms in only about one-third of these. The vestibular nerve was more frequently affected than the cochlear nerve. He states that

40. Schlittler, E.: Beitr. z. Anat., Physiol., Path. u. Therap. (Nov.) 1924.
41. Mayer, O.: Arch. f. Ohrenh. **77.**
42. Hennebert: Soc. med. chir. de Brabant (Oct.) 1922.
43. Spira, F.: Polska gaz. lek. (May) 1924.

arsphenamin treatment had little effect, but that incomplete treatment was apt to aggravate the lesions.

TABES DORSALIS AND THE AUDITORY NERVE

In a recent communication, Mayer [44] records the results of the clinical and histologic examination of the ear in four cases of tabes. He was able to confirm the findings of Habermann, who showed that in tabes there was an atrophy of the protoneuron. Mayer selected four cases with early changes in the hearing and carried out functional tests and later histologic examination of the temporal bones. Degeneration of the nerve fiber could be traced from the cochlea to the nuclei in the medulla. The greatest changes were found in that part of the cochlear nerve between the glial sheath in the internal meatus and the cochlea itself. In this section the nerve was largely replaced by fibrous tissue. Atrophy of the cells in the spiral ganglion was also found. The organ of Corti was not greatly changed and the vestibular nerve similarly was little affected.

TUBERCULOSIS OF THE INNER EAR

Two types are found: the first one in children and the other in patients with advanced pulmonary tuberculosis. The second type is somewhat uncommon. The infantile type is unfortunately very common in certain geographical areas, depending entirely on the milk supply system. Logan Turner's [45] figures showed that 2 per cent. of all patients with middle ear suppuration in Scotland under the age of 15 were tubercular; under 5 years of age 9 per cent. were tubercular; under 2 years 27 per cent. were tubercular, and under 1 year 50 per cent. were tubercular. In most of the last group the disease appeared within the first six months. Practically all the patients were bottle-fed babies who had been fed on unsterilized cow's milk. In 92 per cent. of the cases the onset of the disease was unaccompanied by pain, and showed itself by ear discharge and enlarged periotic glands in 95 per cent. There was facial paralysis in 45 per cent. A sequestrum was discovered in 60 per cent., and in 22 per cent. the labyrinth was necrosed in whole or in part. Fraser [46] states that the infection spreads to the labyrinth from the middle ear usually by way of the oval or by the round windows. The prominence of the external semicircular canal is occasionally the seat of the fistula into the labyrinth, but not nearly so often as in cases of cholesteatoma. On the other hand, the promontory is much more often diseased in tubercular than in simple purulent otitis media.

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44. Mayer, O.: Beitr. z. Anat., Physiol., Path. u. Therap. (Nov.) 1924.
45. Turner, Logan: J. Laryngol. (June) 1915.
46. Fraser: Ann. Otol., Rhinol. & Laryngol. (Dec.) 1923.

Abstracts from Current Literature

Ear

STUDIES OF THE RINNE TEST WITH SPECIAL REFERENCE TO THE TUNING FORK STEM FOR BOTH BONE AND AIR CONDUCTION. ROBERT SONNENSCHEIN, Laryngoscope **34**:929 (Dec.) 1924.

A most extensive and detailed study of the Rinne test has been made by Sonnenschein, especially as to the use of the tuning fork stem for both air and bone conduction. In some previous work on this subject, the author always felt that placing the fork's stem in the meatus did not give hearing only by air, but that the contact with the tissues gave some transmission by way of the cartilage and bone. Attention has been called to the fact that certain writers deny all value to the Rinne test because it measures the difference between two factors, namely, the vibration of the fork's stem and its prongs, which are so different that they are not comparable. However, the test as usually performed gives us the ratio between bone and air conduction and as the same error is made in each test the results can be compared with one another and that suffices for the practitioner even if it does not for the physicist. At any rate, it seemed desirable for the author to demonstrate if possible that air conduction could be tested by means of the fork's stem. While the prongs move in transverse vibration of large amplitude, at the same time and for just as long a period the stem shows longitudinal vibrations of smaller amplitude, and it is quite desirable from the acoustic point of view to test both air and bone conduction with the same type of vibration.

The method used is to excite the fork in the manner chosen by the individual otologist, endeavoring to do this in a definite way in order to get uniform results. The author uses the a^1 fork of Bezold. The stem is held against the mastoid process in the usual manner and the duration of hearing by bone conduction is noted. The stem is then inserted into one end of a rubber tube, the other end of which is attached to a vulcanized rubber olive-shaped tip such as is often used with a Politzer bag, and the latter inserted into the meatus acousticus externus. The duration of hearing by way of air conduction is then noted.

The dimensions of the tubing used were 51 cm. in length; width of lumen, 0.7 cm., and thickness of wall 1.5 mm. The length of the tubing is of no great physical importance, as nearly all the sound is transmitted along the air column, and little if any at all is propagated by molecular conduction along the wall of the tube. This factor is highly important as one of the objections which might be raised to this method of testing air conduction is that the wall of the tube or the hard rubber tip may transmit the sound waves to the cartilage or bone of the meatus and surrounding parts, just as when the rounded end of the fork stem is inserted directly into the meatus. The author demonstrated that the sound waves are transmitted almost entirely through the column of air within the tubing by clamping a portion of the tube in a vise, thus obliterating the lumen. On doing this the sound of the fork is no longer heard. If the fork is placed on the outside of the tube, the sound is heard if the fork rests between the vise and the ear, but if placed on the tubing beyond the vise nothing is heard. If the rubber tube is cut and the sections held in proximity but not in contact with one another, the sound

of the fork is heard by way of the tube lumen. When a steel tube is placed in a vise the sound is transmitted as the lumen is not compressed.

This method of doing the Rinne test was carried out clinically in thirty-five cases, being compared in each case with the usual Rinne method. In twenty-three of these cases the air conduction in both ears was from three to fifteen seconds longer when the fork was connected with the tube. This group included four normal ears, five cases of nerve degeneration, eight combined middle and internal ear cases, and six cases of pure middle ear affection. In two cases the hearing in both ears was the same by both methods. The fork was heard a shorter time with the tubing than with the prongs by from two to ten seconds in nine cases, of which two were moderate nerve degenerations, one a combined middle and inner ear involvement, four were purely middle ear disease, and two were otosclerosis. It will be seen that in most cases, of middle ear disease, however, especially those with negative Rinne, the hearing by way of the tube was somewhat less than with the prongs, whereas, if the hearing had been by way of bone conduction, it should have been increased with the tip in the ear. In general, the ratio between air and bone corresponds very well with that obtained in Rinne tests as usually performed.

THE ETHER TREATMENT OF CHRONIC SUPPURATIVE OTITIS MEDIA. THOMAS HUBBARD, Laryngoscope **34**:941 (Dec.) 1924.

The use of ether in the treatment of chronic suppurative disease of the middle ear is advocated by Hubbard, who reports excellent results. The patient is placed on his side with the affected ear up and the external auditory canal is filled with ether. He is allowed to lie in this position until all the ether has evaporated, which usually takes from ten to fifteen minutes. Whatever débris or discharge is still present is then wiped from the canal with a cotton applicator. After a few treatments at the office the patient is directed to carry out the procedure at home, the treatments being repeated two or three times daily. The author has used this method for handling these cases for five years, and recommends it unreservedly.

CHRONIC PROGRESSIVE DEAFNESS TREATED WITH THE GALVANIC CURRENT. M. L. HARRIS, Laryngoscope **35**:9 (Jan.) 1925.

Some encouraging results are reported by Harris in the treatment of chronic progressive deafness with electrotherapy. The theory underlying the action of the galvanic current is that the negative pole causes a hyperemia, local elevation of temperature and softening with absorption of scar tissue. If this is true in other parts of the body the author felt it should hold for scar tissue in the middle ear. The method of application is simple. The external auditory canals are lightly packed with wicks of absorbent cotton moistened with physiologic sodium chlorid solution to the drum membrane, and the negative pole is applied biaurally to this cotton. The positive pole is applied by means of a copper spatula to the tongue and hard palate, good contact being obtained when the mouth is closed. The current is turned on gradually to the limit of tolerance, not to exceed, however, 2 ma. The galvanic current is allowed to flow from twenty to twenty-five minutes, and then the sinusoidal current for five minutes. The latter current increases the local metabolism and stimulates the muscles and nerves of the middle ear. Treatment is given every other day and bi-weekly tests are made to note the progress. Examina-

tion of the drum membrane immediately after treatment shows the upper half markedly congested and the patient will state that he has an agreeable feeling of warmth in the ears. This feeling of warmth usually lasts for twenty-four hours. Of eleven patients treated, nine showed considerable improvement, especially in that there was much less tinnitus.

OBSERVATIONS IN BONE CONDUCTION AND A DIFFERENTIAL TEST FOR STAPES FIXATION. EUGENE R. LEWIS, Laryngoscope **35**:109 (Feb.) 1925.

A simple observation made by the author is believed by him to be a differential test for stapes fixation. He finds that the vibrating fork held on the root of the zygoma is heard normally almost as loud and as long as it is when placed over the aditus-antrum region of the mastoid. When it is held on the tragus it is heard normally louder and longer than when it is on the zygoma root. When the canal or tympanic cavity is the site of a simple obstructive lesion, the same relation continues to exist — namely, the fork is heard louder and longer on the tragus than on the zygoma root. Cases of nerve deafness also show the same relation between the hearing on the zygoma and the tragus. The author observes, however, that when this test is made on cases of known fixation of the footplate of the stapes, this relation is reversed, the fork being heard on the zygoma root long after it ceases to be heard on the tragus.

These findings are explained by the author as follows: "With the fork on the bone, the vibrations are transmitted directly by bone in all directions; when the perilymph of the scala is encountered by the vibrations they are transmitted normally by the perilymph in such a manner as to effect interaction between the hairs of Corti and the tectorial membrane. With both round window and oval window closed, conceiving the membranous labyrinth as completely surrounded by unyielding tissue, transmission of vibrations in such a manner as to result in interaction of hairs and tectorial membrane would be theoretically impossible; but as long as either or both windows are not so closed, the contained fluid finds a venting which permits the production of the interaction necessary to stimulation of Corti's cells. In case of fixation of the stapes footplate, sound waves conducted directly by way of the bone have no difficulty in stimulating Corti's cells, because of the venting at the round window; but sound waves from the tragus produce almost no stimulation of Corti's cells, owing to the peculiar conditions encountered in the conduction mechanism of the tympanum. They might find access through the internal membrana tympani, but as the same membrane must act as the vent for the waves passing through it to the perilymph, its efficiency in acting thus as a transmitter is greatly lowered. This results in the marked inferiority of the tragus route as compared with the bone route for vibrations in these cases."

SNAPP, Grand Rapids, Mich.

TUMOR OF THE ACUSTICUS IN A SYPHILITIC PATIENT DEAF FROM TRAUMA. HAARAT, Monatschr. f. Ohrenh. **58**:881 (Oct.) 1924.

A man, aged 53, entered the eye service of the hospital, May 20, 1913, with the history that twenty-eight years previously he had received a saber stroke on the nose, left eye and left ear. Since then, the vision in the left eye had been poor. Six years later the left eye began to suppurate and soon afterward was lost. July 10, 1912, the patient suddenly noticed a cloud before the right eye. This increased rapidly in density so that the next day he was unable to

recognize his wife and in a few days he was wholly unable to read. In spite of treatment his vision became worse. Since the saber blow he has been deaf in the left ear.

On examination, no pupillary reaction was found in the right eye; the light gray cloudy lens could be seen but no red reflex could be obtained. Vision equaled movements of the hand close to the face, and there was good perception of light at 6 meters. The eyeball was shrunken with the cornea reduced to a bluish yellow spot about 3 sq. mm. in size. The bulbus was grooved by four depressions corresponding to the attachment of the recti muscles.

Diagnosis: Phthisis bulbi of the left eye; sympathetic iridocyclitis of the right eye.

General findings were chronic bronchitis and pulmonary emphysema. The blood Wassermann test was negative.

The nasal findings were saddle nose, large defect of septum, adhesion of septum and posterior part of right middle turbinate. Ear findings: Both drum membranes were normal. The patient was deaf in the left ear. When Weber's test was performed, the sound was heard best by the right ear. A watch was heard on contact by the right ear (normal distance, 1.5 meters). Whisper was heard at 1 meter. C on the mastoid was heard 7 seconds (normal, 16 seconds). The Rinné test was positive. The low limit was normal. C_1 was shortened to 22 seconds.

Caloric testing with water at 10 C. gave nystagmus to the left after 100 c.c.; nystagmus to the right after 120 c.c. Turning tests revealed: after rotation to the right after nystagmus to the left, 15 seconds. After turning to left after nystagmus lasting 20 seconds. The diagnosis was chronic syphilis of nose and both ears. The patient did not improve under treatment and died of inflammation of the lungs and scurvy.

At necropsy, a tumor of the right acoustic nerve and other pathologic changes were found. The petrous bone was hardened in Held's solution, further hardened in alcohol, decalcified in 5 per cent. nitric acid, washed for forty-eight hours, again passed through alcohols of increasing strength and embedded in celloidin.

The right petrous bone showed a growth the size and shape of a small hazel nut lying at the porus acusticus internus and sending a wide process into the internal auditory canal. Microscopically, the sections showed the facial nerve normal but the branches of the acoustic were thin and compressed. A process of the tumor extended around the foramen singulare and onto the ramus ampullaris inferior, with which it fused. It was attached to the periosteum and had caused lacunar absorption of the bone. A small extension of the tumor reached the crista of the posterior canal. Two fissures were found in the capsule of the labyrinth. One lay between the posterior ampulla and the round window, the other extended from the tympanum to the vestibule and reached from a short distance above to the oval window.

The left petrous bone showed a fissure between the facial canal and the superior semicircular canal. There was ectasia of the ductus cochlearis and loss of Corti's organ. There was connective tissue and bone in both scalae. Much loss of ganglion cells and nerve fibers in the canals of the columella had occurred. The maculae and cristae of the acoustic were degenerated.

It is a remarkable fact that a fracture of the petrous bone can heal without development of labyrinthitis.

Boot, Chicago.

How Does the Labyrinthian Fistula Symptom Occur? Remarks on the Work of S. H. Mygind. Erich Ruttin, Ztschr. f. Hals-, Nasen.-u. Ohrenh. **9**:541 (Jan. 20) 1925.

Among other things, Ruttin comments on Mygind's statement concerning the reversed fistula symptom when Mygind contradicts the views of Nylén and Herzog. Ruttin says that he examined histologically two cases of reversed fistula symptom. One of them bore favorable evidence for the explanation of Bárány, namely, that the occlusion of the ampullary shank with thick exudate would be the cause of the reversed fistula symptom. In the other case, Ruttin furnished another explanation, namely, that the direction of the fistula channel in the bone could be the cause for the direction of the fistula symptom. One single theory is not sufficient to explain the reverse fistula symptom on account of the variation in the form, size and surroundings (granulations) of the fistula. The statement "that a horizontal fistula symptom can be obtained if the post rotary horizontal nystagmus cannot be elicited can perhaps be explained by the fact that the horizontal semicircular canal reacts to a stronger irritation by pressure," is understood by Ruttin that the fistula test abolishes the turning nystagmus, and that the nystagmus of the fistula test is created. Ruttin cannot agree with this statement because he found that the after-nystagmus after turning is not abolished by the nystagmus which is created but that the fistula nystagmus trespasses into the existing after-nystagmus. This can be seen more plainly when rotary nystagmus is created by turning with the head bent forward or by calorization, and when the fistula symptom is elicited in a typical case of fistula symptom with horizontal nystagmus. Ruttin thinks that this is the case, not only because the fistula test furnishes the stronger irritation but also because it is of a different mechanical nature. A literal "lymph current" is not understood according to Ewald's law, but only a shifting and a transposition. To this shifting, caused by turning or by calorization, an additional sudden transposition is added by the fistula test. Furthermore, Mygind says "that fistulas in the vertical semicircular canals furnish the same movements of the eyes as fistulas of the lateral canal, just as one can obtain vertical eye movements when there are fistulas of the lateral semicircular canal or of the median wall of the tympanic cavity." Ruttin explains the circumstance that the nystagmus in the fistula test does not always correspond with the plane of the semicircular canal by the statement that this is caused by the variation in kind, size and surroundings of the fistula and possible changes in the interior of the labyrinth. Mygind states that "as a rule the fistula symptom not only increases or decreases during the pressure but also continues, as long as pressure is exercised. A lymph current can, however, only be created, when the pressure is changed and not when it is continuous." Ruttin claims that a lasting pressure cannot be created by compression of the bulb. Yet one can imagine that a constant pressure can keep the cupola shifted for a longer period. Besides, it is not correct that the nystagmus, in the fistula symptom, lasts evenly so long as the pressure lasts. Mygind states that, "when, during the operation direct pressure is exercised on the fistula, as a rule, a slow phase is seen to one side. After cessation of the pressure, the eyes return only to the middle line and not first to the opposite side. If the first eye movement would be caused by a lymph current and by a shifting of the cupola, caused thereby, one could expect, after cessation of the pressure that the endolymph would travel in the opposite direction and shift the cupola back. Then the eyes should move

to the opposite side. "Ruttin claims that in the typical fistula symptom, when pressure is exercised on the exposed fistula, a slow movement of the bulbi to the opposite side occurs. After cessation of the pressure, the bulbi simply return to the middle line. That they should go entirely to the opposite side could only be expected if the shifted cupola would swing freely like a pendulum. If the suppositions would be always the same and so simple, then the nystagmus to the opposite side should always occur after cessation of pressure. Under favorable circumstances, this is the case. (Neumann and Ruttin: Fistula Symptom Without Fistula in Secretory Catarrh, *Monatschr. f. Ohrenh.*, 1923.) Mygind claims that: "The objections refer not only to the 'old fashioned' fistula symptom but also to the vasculary fistula symptoms in their various forms." Nylén and Karlefors described a so-called pseudofistula symptom in certain cases of defects in the drum membrane. It is not a reversed but a real fistula symptom, although it is elicited by way of the fenestrae. Its mechanism of excitation must be considered a riddle, because not only each of its "fathers" but also Bárány stand by their particular explanation. Ruttin considers that the mechanism of the pseudofistula symptoms is a riddle, but perhaps it has no uniform cause, or causes may be underlying which we do not yet know. Alexander thinks of an abnormally movable stapes. In the only case which so far has been examined histologically by Ruttin, he found the cause to be, without doubt, a central process (*Transactions of the German Throat, Nose and Ear Society, 1921*). At last Mygind says "that the fistula symptom in syphilis is always reverse." Ruttin cannot agree with him. At least in congenital syphilis Ruttin frequently found the Hennebert symptom corresponding with the typical fistula symptom. Ruttin claims that Mygind is not justified in assuming that the fistula symptom is an otolith reaction, aside from the circumstance that, in assuming the only effect of the fistula test on the otolith membranes, he does not consider the existence of the ampullae.

AN ADJUVANT FOR THE LIP READING OF THE HARD OF HEARING. MUCK, Ztschr. f. Hals-, Nasen-u. Ohrenh. **9**:545 (Jan. 20) 1921.

During the last war, Muck made two observations on soldiers who had become psychically totally deaf. First, those soldiers took lip reading lessons, which was not a correct procedure. It was astonishing what splendid results were obtained. Muck claims that these soldiers in daily intercourse with people, "heard subconsciously," while simultaneously they saw how the word or sentence was formed. The second observation concerned a patient who carried a cannula in her trachea. On account of the presence of the cannula the patient could not whisper. She could only repeat words without sound. Yet Muck was able to recognize whether the patient repeated the words correctly or not by carefully watching her lips, although he was not accustomed to lip reading. Muck then considered whether these two procedures described before could be utilized as practical preparatory exercises and interim exercises in instruction in lip reading. In this instance, the teacher does not propose a problem which the pupil must solve, but the teacher is a living phantom and the pupil must repeat, in low whispers, the words and sentences which are thus conveyed to him. It is a method which should be added to the customary exercises, and it can be used when the pupils are fatigued. Mueller of the school for the hard of hearing (in Essen) spoke favorably of this method.

THE SOUND OUTFLOW "SCHALLABFLUSS" THEORY OF ERNST MACH. W. TONNDORF, Ztschr. f. Hals-, Nasen-u. Ohrenh. **9**:548 (Jan. 20) 1925.

1. In other theories which have been advanced to explain the physiologic Weber test, single processes are generalized and used as principles of explanation, but the sound outflow theory of Mach excells in theory fundamentally by the fact that it tries to comprehend the phenomenon as a whole.

2. To the previously existing experimental proofs, a new one has been added. Where the former experiments worked with the impediment of the sound flow the new proof could be demonstrated by facilitating the sound outflow. The proof could be shown on the living person as well as on the model.

3. Theoretic and experimental considerations, combined, allow the conclusion that Mach's sound outflow theory is at present the most useful hypothesis for understanding the cause of the sound increase in the physiologic Weber test.

4. The explanation in pathologic cases must be based on the theory which has been proved useful and justified in the physiologic experiment. In 1509, Capivaccio is said to have utilized for diagnostic purposes the fact that sound waves can reach the hearing organ by way of bone conduction.

Wheatstone in England, Tourtual in Muenster and Ernst Heinrich Weber in Leipsic, found that the tone of an instrument placed on the head (Weber and Wheatstone used the tuning fork, Tourtual a watch) could be heard better when both ear canals were closed by the finger. If one canal was closed, the tone was heard better in the closed ear. Mach claims that: "if the sound from the air enters the labyrinth through the meatus then it must also be able to reach the outside easily from the labyrinth. If the bones of the skull, and indirectly also the labyrinth, experience a permanent periodic concussion, then a constant mode of vibration will be established at each point of our cranial bone system. The living force of the sound present at each point is measured by the constant difference of in and outflow." Claus, by preventing the escape of the sound, proved the correctness of Mach's theory on the model by showing the increase of sound. Tonndorf asked himself what would occur if the escape of the sound could be facilitated. This has, to Tonndorf's knowledge, never been done before. A long sound funnel was placed on the meatus, and in this manner better conditions for the escape of sound were created. Then a sounding tuning fork was placed on the mastoid process. When the tone was not heard any longer, the funnel was removed. This made the outflow of sound more difficult and the sound was again heard. When the sound had disappeared again the meatus was closed by the finger. A loaded C fork after Gradenigo (128 vibrations) was used and placed always on the same spot of the planum mastoideum. On an average, the first experiment showed 33 seconds with the sound funnel and 40 seconds without the funnel. The other experiment showed, on an average, 32 seconds with the sound funnel, 39 seconds without the sound funnel and 44 seconds with a closed meatus. Tonndorf made an experiment on the model with the same result as those in the living person.

HOW DOES THE CALORIC NYSTAGMUS ORIGINATE? S. H. MYGIND, Ztschr. f. Hals-, Nasen-u. Ohrenh. **11**:68 (March 14) 1925.

In 1905, Barany advanced the theory that nystagmus must be ascribed to a movement of the cupola in consequence of an endolymph current, especially in the lateral semicircular canal, induced either by heat or by cold. In this

simple manner the opposite effect of heat or cold and the reverse action, by bending forward, is explained. It can also be explained that bending toward the cold calorized side creates a more horizontal nystagmus (sometimes a rotary reverse action is observed) whereas bending to the opposite side creates a more rotary form (sometimes a horizontal reverse action).

In 1920, Borries commented on the experiments made on pigeons and concluded that in some pathologic cases only a caloric nystagmus, in other cases only a turning (post rotary) nystagmus could be elicited and he expressed the opinion that the first is elicited through the otoliths, the latter through the semicircular canals. When he removed the semicircular canals in pigeons he could exclude the turning but not the caloric nystagmus. Thornval, however, could not elicit a caloric nystagmus after the removal of the semicircular canals. De Kleyn and Lund do not agree with Borries; they obtained entirely normal caloric reactions in various positions of the head in guinea-pigs in which the otolith membranes were thrown off and in which all otolith reflexes had ceased.

Mygind had always doubted the correctness of Barany's interpretation, but the possibility of the correctness must be admitted after the experiments of Meyer and Lion concerning the currents of fluids in capillaries when the temperature is changed. Lately Mygind found a large number of otolith cases. In these cases nystagmus appears in certain positions of the head, no matter by which movements these positions have been reached. In typical cases, this nystagmus continues so long as the head is kept in the same relation to space. It also agrees somewhat with the caloric nystagmus, if it is either rotary to the same side or horizontal to the other side, in a lateral position of the head. When the head is bent forward, sometimes a downward vertical nystagmus appears as is frequently found in pathologic cases on calorization, but it does not change the direction to the side when bending forward.

Many of the caloric symptoms were apparently riddles, yet, as a whole, the spontaneous otolith reactions were reflected in the caloric reactions. Therefore Mygind thought that the otoliths participated in the caloric reaction. Mygind believes that the only vestibular reaction about which we know with some certainty where and how it occurs, is the nystagmus after turning. It cannot be denied that the otoliths may play a part in it, yet, in the main, it must be regarded as a reaction of the semicircular canal caused by a movement of endolymph. Mygind asked himself in what relation this well established reaction stood to the caloric nystagmus. In those cases in which the nystagmus after turning furnished values which had to be considered as a diminished or abolished reaction, irrigation of the same side, in most cases, resulted in a pathologic reverse action. This happened, as a rule, in such a manner that it was missing on bending forward, while the nystagmus continued in the same direction. In other cases it became downward vertical, oblique or rotary, or the eye remained entirely still. This observation was not new. Borries had observed it in 1920 but had not drawn any conclusions therefrom. In many cases one can find a pathologic reverse action with after turning anomalies. In practically all cases of this nature, Mygind could establish a spontaneous nystagmus, as a rule with the outspoken character of an otolith nystagmus, which was active in the same direction as the nystagmus which was observed when bending forward.

From these observations Mygind drew the following conclusions: The caloric nystagmus consists of two reactions, one of which furnishes a reverse action "Umschlag" after bending forward. The one is a reaction of the semi-

circular canal, the other of the otoliths. The reaction of the semicircular canals is incited in all canals especially in the lateral, because it is the most exposed to temperature changes. In pathologic cases the horizontal or the rotary component can be more or less pronounced according to the functioning of the lateral or the vertical canals. The other reaction, the otolith reaction, must be attributed to a change of tonus of the otolith organs probably caused by a change in temperature. The tonus increases by warming, it decreases by cooling. The result is, in the first instance, a horizontal — rotary nystagmus to the same side, in the latter to the opposite side. The change of nystagmus in lateral position corresponds to the usual otolith nystagmus and also to the usual caloric nystagmus. The otolith reaction, however, does not become reversed when bending forward. The effect on the macula must probably be attributed to an indirect thermic irritation or paralysis. In a simple manner the great variation can be explained which the caloric nystagmus can exhibit in pathologic cases. The reaction is determined by the condition of the neuro epithelium of all three semicircular canals and of the two maculae of both labyrinths. If both sides are diseased, each of the ten regions can be affected in a variable manner, from a condition of hyperirritability to a condition of an abolished function. Besides, the particular macula or crista may be affected differently and may function differently in its various parts, as Wittmaack's experiments concerning the hydrops labyrinthi have shown. Mygind's otolith cases correspond exactly with these experiences.

In view of these considerations it can be understood why a vertical nystagmus downward is found so frequently when bending forward. In this position, it can happen that an otolith nystagmus toward the opposite side is balanced by a semicircular canal nystagmus to the same side, whereby, in this position, the physiologic but otherwise latent otolith nystagmus appears, perhaps supported by a corresponding nystagmus incited by a current in the vertical semicircular canals. Hot irrigation as a rule does not create a vertical nystagmus while bending forward, because the downward vertical nystagmus, characteristic of this position, is balanced by the upward semicircular canal nystagmus, which now belongs to the reverse endolymph current. Corresponding conditions obtain when bending backward, so that usually only the cold calorization produces an upward vertical nystagmus. A vertical caloric nystagmus can also appear in a normal position of the head. It must be assumed that each labyrinth has a tonus which expresses itself by a homonymous horizontal rotary nystagmus but also by a nystagmus downward.

In normal persons it has been observed sometimes that, by cold calorization, a vertical nystagmus upward is produced and by warm calorization, a vertical nystagmus downward (Barany, Borries). The well-known cases of dissociation between the caloric and turning reaction which is frequently found in syphilis, but which is not pathognomonic for the same, can be explained in the following manner. When the reaction on turning is missing, the function of the semicircular canal is gone, whereas the caloric reaction is only missing when the total vestibulary function is so weak that it does not respond to the comparatively weak caloric stimulus but only to the far stronger turning stimulus. According to Kobrak's method, the weak irritation frequently produces a better reaction than application of large amounts. This may possibly be attributed to pressure which reaches the endolymph. In stronger degrees (fistula symptom, pseudo fistula symptom) a homonymous nystagmus results, a nystagmus acting against a cold caloric nystagmus. Kobrak himself mentioned the effect of pressure in the meatus on the caloric reaction under other

conditions. He does not, generally, obtain a reverse nystagmus contrary to Barany, who claims that he always obtains a reverse nystagmus. The cause may probably be found in the circumstance that the minimum irritation affects principally the otoliths, whereas the endolymph current is only affected by a greater effect of temperature. Mygind claims that Barany is correct with his theory of the effect of the endolymph current, but that it suffices only for half of the reaction. Bartels is also correct with his theory of paralysis and irritation, but it is principally applicable to the otolith organs.

The experiments of Lunds and de Kleyn are correct, but they do not entitle the authors to conclude that the otolith organs do not play a part. The theory of Borries is correct but not complete. The experiments of Borries do not coincide with the theory of Mygind. Borries found a caloric reverse action when the head was bent foward in pigeons in which the semicircular canals had apparently been removed. This circumstance cannot be explained by the fact that birds, contrary to mammals, possess two extra otoliths, the lagena and macula neglecta. Mygind claims that in physiologic experiments many circumstances can come into play which are not clear at present.

AMBERG, Detroit.

Pharynx

SUCTION TONSILLECTOMY. FRED W. BAILEY, Laryngoscope **35**:161 (Feb.) 1925.

The technic of removing tonsils by suction and snare has been devised and described in detail in various articles by J. B. H. Waring, who claims many advantages for the method. Bailey equipped himself with the instruments and gave the method a most careful and thorough trial in about thirty-five cases, and he was compelled to decide that it was inferior to some of the ordinary methods that are in common use. He was unable to substantiate the originator of the idea in scarcely any of the many advantages claimed for it, but on the other hand found many difficulties in its use. He believes the dissection and snare method the most satisfactory on the whole, although he highly recommends the Sluder method in selected cases.

SNAPP, Grand Rapids, Mich.

Nose

IMPLANTATION OF STENSON'S DUCT INTO THE ANTRUM FOR THE RELIEF OF DRY FETID CATARRH. J. E. SHEEHAN, Laryngoscope **35**:23 (Jan.) 1925.

The author reports a case of marked atrophic rhinitis in a woman, aged 23, who also complained of severe generalized headaches, in whom he implanted Stenson's duct into the right antrum. There was marked atrophy of the turbinate bones and membranes of the whole intranasal parts. The disease was more marked on the right side, consequently it was decided to perform the operation on that side. The salivary discharge from the duct washes out the antrum and the nose, the excess passing into the mouth. At the time of the report, several months after the operation, the intranasal parts showed the absence of crust formation or bleeding areas, with a marked regeneration of the mucous membrane, and disappearance of the headaches.

SNAPP, Grand Rapids, Mich.

OSTEOMA OF THE ACCESSORY SINUSES. VULOWITSCH, Monatschr. f. Ohrenh. **58**:869 (Oct.) 1924.

After the fundamental work of Bornhaupt, and particularly after the later work of Boenninghaus, Sonnenkalb, Birch-Hirschfeld, Eckert and Dahmann,

there is but little new to be said about osteoma of the accessory sinuses, but because of the rarity of this interesting tumor the following three cases are reported.

CASE 1.—A girl, aged 18, had noticed a slowly growing swelling in the inner angle of the left orbit for seven years. Visual acuity in that eye had decreased so that for four years she had been blind. The left naris was completely stopped for three years but she could breathe well through the right naris. The left eyeball was pushed downward to the maximum and stood 1.5 cm. lower than the right. It was soft but not tender to the touch. About half of the left orbit was filled with a hard, resistant mass. Optic atrophy with amaurosis was present. Rhinoscopy showed a large hard yellowish tumor with an almost smooth surface. The septum deviated slightly to the right side, but was otherwise quite normal.

A roentgenogram showed a massive shadow filling almost the whole orbit, the whole ethmoid area, the greater part of the maxillary sinus and a large part of the sphenoid sinus.

The tumor, extirpated under conduction anesthesia without ligature of the external carotid artery, was almost the size of an apple and had many knobs. The rather profuse bleeding prevented the examination of its extent of attachment. Healing progressed smoothly and the optic nerve recovered enough for the patient to count fingers at 1 meter. The exophthalmos improved but slightly. Paralysis of the oculomotor and trochlear nerve persisted.

CASE 2.—A woman, aged 22, had nasal obstruction and polypi which protruded from the left nostril. During the removal of the polypi an oval structure the size of a pigeon's egg was found. It was covered with red mucosa and at first was mistaken for a polyp. The probe showed it to be as hard as stone. Nasal obstruction had been present for four or five months and a mucopurulent discharge for one year. There was no other complaint.

The tumor, removed by a Denker operation, was found to arise from the ethmoid near the infundibulum. Healing took place in less than two weeks.

CASE 3.—A youth, aged 20, had noticed a growth on his forehead above the right eye for two years, which caused neither pain nor discomfort. He consulted a physician in order to have this facial blemish removed. The only fact of importance in the history was a fall several years before, in which he struck his head a hard blow. Examination showed a hard protuberance in the middle of the forehead and extending toward the right side. On palpation, a parchment-like crepitation could be felt in places, particularly about the middle of the tumor. The eyeball was pushed downward and outward. A heavy aspirating needle could not be pushed into the tumor. Anterior and posterior rhinoscopy were negative. There was no discharge and no displacement of structures inside the nose. Roentgenograms in the occipitofrontal direction gave a dense rounded shadow, which was quite well defined with the upper border of the frontal sinus visible. The profile view did not give an even homogeneous shadow, but rather an irregular jagged clear strip seemed to divide the tumor into two parts — an anterior dense and a posterior less dense part. The cerebral wall of the frontal sinus appeared to be intact.

An operation was performed under general anesthesia. A vertical incision 6 or 7 cm. long revealed a hard, yellowish tumor with lumpy yet smooth surface lying just under the skin. In the middle the bone was eroded and the tumor exposed. After removing the whole anterior wall of both sinuses, a tumor 5 cm. high and 7 cm. wide was found in the sinuses. An extension

3 cm. long lay in the right orbit with a little less than 2 cm. in the recessus nasalis. A mucocele was found in the unoccupied portion of the left frontal sinus.

It was not possible to remove the tumor whole, on account of danger of injuring the posterior wall of the sinuses. The anterior denser part was cut off with a Gilgi saw and the remainder chiseled away with a gage. The tumor arose from the posterior part of the interfrontal septum.

In all, 240 cases have been reported in the literature—a number which shows clearly the rarity of this growth. It is more common in males. The three patients reported had no discomfort except from the displacement of the eyeball.

Boot, Chicago.

Concerning the Chronic Inflammation of the Maxillary Antrum. Alexander Iwanow, Ztschr. f. Hals-, Nasen-u. Ohrenh. **9**:483 (Jan. 20) 1925.

Iwanow distinguishes three forms of chronic inflammation of the mucous membrane of the maxilliary antrum, and proposes to call the diseases of the maxillary antrum "maxillitis." He calls these: (1) Maxillitis chronica hyperplastica; (2) maxillitis chronica atrophica and (3) maxillitis chronica purulenta. He speaks exclusively of the simple inflammation of the mucous membrane of the maxillary antrum, and not of the infectious inflammations such as syphilis, tuberculosis, etc.

Maxillitis purulenta is recognized the most easily, but it must be divided into several categories. Maxillitis atrophica is more difficult to diagnose and still more difficult is maxillitis hyperplastica. The character of the nasal secretion is of importance for the differential diagnosis between maxillitis hyperplastica and rhinitis hypertrophica. In the latter the secretion is thick, exudes with difficulty and gathers in the lower meatus; in maxillitis it is thin, very profuse and does not stagnate in the lower meatus. The alternating occlusion of one side and of the other side is also a symptom of the chronic catarrhal inflammation of the nose, but in this instance it depends on the position of the head and of the body. The nose is obstructed on the side on which one lies. In maxillitis this dependence on the position is missing. In nasal catarrh the occlusion varies quickly and often, whereas in maxillitis it lasts longer. So far as the roentgen-ray diagnosis comes into consideration, it is of no significance in this form of disease. The isolated maxillitis hyperplastica shows the following symptoms: 1. Obstinacy of the course and unsuccessful treatment of the chronic coryza. 2. Limited bulging of the mucous membrane in the region of the anterior fontanella. 3. Retarding of transillumination of the affected side. (If an unlighted lamp is introduced into the mouth and if the current is slowly turned on and increased, one notices in some cases that only one side of the face is transilluminated. If the current is still more increased, both sides are equally transilluminated. The room must be absolutely dark.) 4. Thin, copious secretion which does not stagnate in the nose. 5. Changing, long lasting obstruction of the nose. If the symptoms of ethmoiditis hyperplastica are added to this picture, then the diagnosis of maxillitis is certain. Of course, not all the symptoms described need be present. A case in point is cited which was cured by operation. The mucous membrane of the nasal wall was found to be much thickened and uneven, otherwise it was evenly thickened. The mucous membrane of the nasal wall was removed with the sharp spoon and care was taken not to bare the bone.

Iwanow then describes maxillitis chronica atrophica, of which no mention is made in the literature. This form undoubtedly exists but is overlooked, because it can exist without causing severe subjective symptoms. Two cases in point are cited. The following objective symptoms are characteristic. 1. Anemia and atrophy of the mucous membrane of the nose. 2. Fetor on inflation or on diagnostic puncture. 3. Emptiness of the cavity (missing of the characteristic noises on inflation). 4. Cloudy return of the irrigation fluid. 5. Retarded transillumination. Subjectively, a bad odor from the mouth or nose is encountered and excretion of fetid mucous and pain on the affected side are noticed.

Maxillitis chronic purulenta is the most frequent and easiest recognizable inflammation of the maxillary antrum. Contrary to the hyperplastic form, the purulent conditions are usually unilateral. The presence of polyps speaks for simultaneous disease of the ethmoidal cells. Experience teaches that not all cases of suppurative maxillitis resemble one another, that all do not take the same course, that they do not furnish the same picture when operated on and that the postoperative course may vary with the same technical procedure. In the numerous patients who were operated on by Iwanow, he found a little thickened mucosa in the cavity with a small amount of granulation in some. In others, there was a thickened rough mucosa, with numerous polypoid proliferations especially in the alveolar recess and in the region of the ethmoid cells. The first form can be designated maxillitis purulenta simplex, the latter maxillitis purlenta hypertrophica. The latter forms correspond with the mixed forms of Uffenorde, who considers them to be a chronic, serous catarrhalic inflammation, complicated by an acute purulent infection. Iwanow cannot agree with this view. Uffenorde claims that a serous catarrhalic inflammation always starts in the region of the ethmoid cells and that it may extend to the maxillary cavity. He assumes that in mixed forms of inflammation of the antrum of Highmore the ethmoid cella are always diseased. Yet it is frequently observed that forms are isolated without affecting other cavities. The postoperative course in maxillitis purulenta simplex is short. The fluid for irrigation soon becomes clear. The course in the hypertrophic form is slow. The purulent secretion decreases gradually and very slowly. Iwanow's observations have shown still another form of purulent inflammation of the maxillary sinus he frequently encountered in patients who had submitted themselves to a Cooper operation and who continued, for years, to wash out the antrum. They resolve to be operated on radically because they cannot stop the flow of the secretion. In such patients one would expect to find the mucous membrane very thick and covered with polypoid granulations. In reality, one finds a thin unchanged mucous membrane and only a few granulations on the floor of the cavity, surrounding the fistula opening. This allows the conclusion that the granulations were caused by the foreign body. If this is true, removal of the foreign body would suffice for a cure. In some patients Iwanow succeeded in obtaining a cure in this manner; in others, he was obliged to operate. Iwanow nevertheless recommends an operation. The condition in such cases can be named maxillitis purulenta circumscripta. The typical clinical picture consists of: absence of pus and crusts in the middle meatus, absence of hypertrophic inflammation of the nasal mucous membrane, absence of a purulent secretion during the day and presence of pus in the irrigation fluid. Iwanow recommends surgical interference in all cases of chronic inflammation of the maxillary antrum. He prefers the extranasal method, because this method alone allows close inspection of the mucous membrane. In scraping he avoids

removing the whole mucous membrane. He only removes it where it is very much changed, where it is uneven or where it shows polypoid thickening.

AMBERG, Detroit.

Miscellaneous

THE TREATMENT OF BRAIN ABSCESS. JOSEPH E. J. KING, Laryngoscope **34**:974 (Dec.) 1924.

Practically all operative procedures heretofore described in the treatment of brain abscess have been based on three well recognized principles: (1) The drainage of the abscess cavity; (2) prevention of extension of meningeal infection; (3) prevention of hernia cerebri. The difficulties and dangers of the usual drainage methods are many. Secondary abscess frequently develops in the neighborhood of the intended drainage tract, a pocket of pus may accumulate in some portion of the abscess cavity and fail to be drained, or may even enlarge and rupture into the ventricle. Innumerable types of drains have been used but none are really adequate in the sense that the cavity quite drains out, and a complete permanent obliteration takes place followed by a high percentage of recoveries. Drains often become dislodged and are replaced with difficulty, frequently being inserted into brain substance outside the tract. Fatal results have followed perforation into the ventricle in such instances.

The method used by King in the treatment of these cases consists, briefly, in making a trephine opening through the skull directly over the lesion, and, on determining the exact location and extent of the cavity by means of a trocar, the opening is enlarged to the size of a silver dollar or larger, depending on the size of the abscess. A 0.5 inch incision is then made into the suppurative area and a soft rubber catheter with a Luer syringe attached is inserted and the contents are withdrawn. The cavity is then washed out repeatedly with surgical solution of chlorinated soda. The incision in the cortex or "roof" of the abscess is carried to a point on the margin of the cavity and then around it in a circular manner, so that the entire "roof" of the cavity is removed. The exposed capsule is then wiped dry following free irrigation with the solution. The floor of the abscess cavity will then be seen to become less concave, with a tendency to rise somewhat into the operative field. No drainage tubes or drainage material of any kind is inserted. A fenestrated rubber dam is placed over the cavity and over this gauze wet with surgical solution of chlorinated soda. This is kept wet by means of Dakin's tubes.

The after care, with attention to details, is important. Dressings should be done daily. The cardinal points in the care of the patient, which will result in recovery are: (1) Allowing of temporary herniation of the brain, carrying with it the remaining portion of the abscess cavity; (2) combating of infection by the use of surgical solution of chlorinated soda; (3) prevention of trauma to the brain hernia during the period of combating infection and the subsequent recession of the hernia; (4) prevention of over distention of the ventricular system by means of lumbar puncture, if indicated; (5) strapping of the wound with adhesive strips after the slight necrosis on the surface of the hernia has ceased and the surface of the hernia has become covered with healthy granulations followed by recession of the hernia with epithelization.

The hernia may become of considerable size, from the size of a small lemon to that of a small orange. No part of it should ever be cut away, neither should it be compressed except as before mentioned. The patient is usually up and about the ward before the hernia is ready for even the slightest

compression. The average time required from the time of operation until the hernia has completely receded and the granulating surface becomes covered with epithelium in from two to three months.

CONTRIBUTIONS TO THE STUDY OF THE SPHENOPALATINE GANGLION. SIMON L. RUSKIN, Laryngoscope **35**:87 (Feb.) 1925.

A most extensive and detailed anatomic study of the nasal ganglion and surrounding structures has been made by Ruskin, with especial reference to the method of approach for injection of this region. The author concludes from his study that a disturbance of the sphenopalatine ganglion must not be considered as an entity but rather as a combination of four different factors; namely, a trigeminal maxillary syndrome, a sensory facial nerve syndrome, a sympathetic syndrome and a local sphenopalatine ganglion syndrome coming from the cells located in the ganglion proper. Usually combinations of the above syndromes occur.

For surgical purposes the ganglion may be considered as a sensory unit supplying to a large extent the sensation of the nose, the sinuses, the roof of the mouth, the tonsils and part of the pharynx. Near it lies the maxillary nerve and the two together supply the integument of the cheek, the fore part of the temple, the lower eyelid, the side of the nose and upper lip, the lining membrane of the nose, the mucous membrane of the upper part of the pharynx, of the antrum and posterior ethmoidal cells, the soft palate, tonsil and uvula, and the glandular and mucous structures of the roof of the mouth. From this it is seen that the ganglion region is of great surgical importance, especially from the standpoint of anesthesia. The author has worked out a very satisfactory method of injecting the ganglion by means of a specially devised syringe, the needle of which is inserted through the posterior palatine foramen in the hard palate just medial to the second molar tooth. The needle, after entering the foramen, follows the posterior palatine canal to the ganglion. The author uses a 22 gauge platinum needle, 45 mm. long, mounted on a syringe at about an angle of 45 degrees. With the patient lying down and the head extended, the canal, which is almost vertical in the sitting position, is brought into a plane 45 degrees to the horizontal. The needle is inserted through the foramen into the canal to a depth of 3.5 to 4 cm. It is then opposite the sphenopalatine foramen and directly in the ganglion. By advancing the needle 5 mm. deeper, the point comes to lie medial to the maxillary nerve which can then be injected if necessary.

The author has been using sphenopalatine ganglion anesthesia by this method for tonsillectomy, radical antrum operations and radical ethmoid and sphenoid surgery with excellent results. For anesthesia 1 per cent. procain with epinephrin is used, while for alcoholic injection the posterior palatine canal is first located with procain then followed with the alcohol. A large number of conditions are listed which have proved amenable to treatment through the ganglion.

SNAPP, Grand Rapids, Mich.

CONCERNING THE TECHNIC OF RADIUM PUNCTURE. E. LEUSCHER, Ztschr. f. Hals-, Nasen-u. Ohrenh. **9**:419 (Jan. 20) 1925.

The author describes the technic of puncture by hollow needles with radium salts, radium emanations and mesothorium salts, into the disease focus. He claims that the results depend greatly on the technic, and describes the technic concerning the method of application, the filtering and the dosage

employed in the otolaryngologic clinic in Berne. Considerable improvements can be accomplished even in large tumors, therefore, in inoperable tumors of the upper respiratory and digestive channels it appears to be unconditionally indicated. To what extent a lasting cure is obtained cannot yet be stated, because the technic has been employed for only one year. The details should be read in the original.

HARMONIOUS ELECTROVIBRATOR. E. N. MALJUTIN, Ztschr. f. Hals-, Nasen-u. Ohrenh. **9**:429 (Jan. 20) 1925.

In 1896, the author proposed a new method of developing and of treating the voice with the aid of tuning fork vibrations. Since that time he has several times described patients in whom various defects of the voice have been cured. The late Professor Gutzmann was interested in this method, and constructed an electric apparatus which he used to develop the voice of deaf-mutes by aid of this principle. He described his apparatus first in 1909. Maljutin called his apparatus the tuning fork harmonium, and worked with singers and orators using the apparatus like a piano. The harmonious vibrations were transferred to the chest and head of the patient, and those cavities were caused to covibrate which had to vibrate according to the art of singing. The apparatus allowed the voice to begin in such a manner that the vocal cords were not strained and that the muscles of the pharynx and larynx were not over exercised. Yet the vibration of the high forks were too weak. Therefore Maljutin used steel plates instead of tuning forks. These plates were set in motion by electro magnets. The vibrations were transmitted by acoustic telephonic receivers, which lately have been used to govern large places acoustically, such as in radio sets. When a singer who cannot sing, or a speaker whose voice is without timbre, sings or speaks, accompanied and fitted with the telephone placed on the chest, he is astonished at the power of the tones which emanate from the chest. Electric treatment in phonasthenia, paresis of the vocal cords, etc., can be combined with the use of these instruments. A description of the apparatus is given.

A CASE OF PSEUDO TUMOR OF THE UPPER JAW CAUSED BY AMYLOIDOSIS OF THE LACRIMAL DUCTS. GUMPERZ, Ztschr. f. Hals-, Nasen-u. Ohrenh. **9**:434 (Jan. 20) 1925.

Since the publication of Pollak, a comparatively small number of cases has been reported. In June, 1922, a patient, aged 24, consulted an oculist on account of pain in the right eye. The eye was not diseased, but a tumor in the region of the right lacrimal sac was found. Four weeks later, this tumor was removed under local anesthesia. The tumor reappeared in April, 1923. In May, 1923, the tumor was removed in the surgical university clinic in Heidelberg. This was followed by epiphora. August, 1924, the floor of the right nostril was found swollen in its anterior portion. The mucous membrane appeared to be normal. A firm prominence was found above the incisors on the right side. July 28, the patient was operated on under local anesthesia. An incision extending beyond the middle line was made beginning at the second premolar of the right side. When the mucous membrane was separated upward, a firm tumor was encountered which was easily isolated. The free border of the apertura piriformis had disappeared from the pressure caused by the tumor. The anterior wall of the antrum of Highmore was bent inward but the cavity was not opened. The tumor was of the form and size

of a prune. It reached to the beginning of the lower turbinate. The mucous membrane of the floor of the nose and of the lateral wall could be separated only with difficulty. The anterior end of the lower turbinate was removed because the tumor reached directly into the same. The maxillary antrum was not opened. The patient made an uninterrupted recovery.

Microscopic examination of the tumor showed that it was, without doubt, an amyloid tumor. This was established by the positive result of the staining with congo red and methyl-violet. It must have originated, in all probability, from the saccus and ductus lacrimalis. Local amyloidosis of the lacrymal sac has been described in the ophthalmic literature repeatedly, although those processes had not been so extensive as ours. In the case described by Gumperz, an amyloidosis of the whole tear duct system, saccus and ductus lacrimalis, had occurred, which had extended downward to the entrance of the naso-lacrymal duct into the lower nasal meatus.

A Case of Excess Formation of the Tracheobronchial Tree. Hasslinger, Ztschr. f. Hals-, Nasen-u. Ohrenh. **9**:460 (Jan. 20) 1925.

Hasslinger adds another case which he observed in Hajek's clinic to the literature. The bronchoscope showed two entrances at the lateral wall at the right main bronchus. Pliable probes with roentgen-ray examination proved that an extra bronchus and not a diverticulum was present. Through necropsy findings it is known that an accessory bronchus can stand in various relations to the lung. Mueller and Herxheimer have described cases in which the accessory bronchus provided for an accessory lung which was separated from the other lung. In Chiari's cases it participated in the apical parts of the upper lobe.

The Early Use of the Bougie According to Salzer in Lye Erosion of the Esophagus in Children. J. von Bokay, Ztschr. f. Hals-, Nasen-u. Ohrenh. **9**:534 (Jan. 20) 1925.

The deep rooted principle existed of waiting until the fourth or eighth week before using the bougie after the cicatrization of the ulcer had taken place. Therefore, no attention has been paid to the prevention of the stricture. The early use of the bougie was resorted to by a few; Johannessen (1900) and Zachariae (1914), began to use the bougie on the tenth day, Fraenkel and Bass at the beginning of the third week. Gersuny in Vienna (1887) and Roux in Lausanne (1913), had tried the early permanent application of the bougie in order to prevent the stricture. Yet the early use of the bougie could not become established. In 1924, Salzer very correctly remarked that the doctrine of the danger of the early use of the bougie had found such a foothold that it had scarcely been noticed that these injuries had practically remained the only ones in which the surgical principle had not been used to prevent cicatricial changes or distortions by prophylactic measures. In 1920, Salzer, after observing twelve grave cases, very warmly recommended that the systematic use of big bougies should be started on the second to the sixth day, because by this early treatment, in each case, the formation of a cicatricial stricture had been prevented. Salzer used the thick No. 30, black caoutchouc bougies of Bass, which are filled with grains of shot. On account of their weight, they enter the esophagus almost by themselves if they are first put in warm water. Salzer left the bougies in place for one-half hour, and used them every day in the beginning, later only every second day and at last only once a week.

The early use of the bougie in children is suffered without trouble, and Salzer emphasizes that it is much more gentle than the treatment of the stricture and that it is scarcely ever accompanied by pain. The children can be well nourished from the beginning, which is a great advantage. During the first week only fluids are used, the second week however, milk foods, vegetable and meat purée could be started, so that the weight not only did not decrease but increased. In 1924, Salzer reported fifty-six cases and came to the conclusion that it was our duty to start the early treatment. Bokay followed Salzer's advice and treated 148 patients from March 3, 1920, to May, 1924. In light cases the treatment was started on the second, in grave cases on the sixth day. Bokay also used bougies Nos. 31 and 32. The first time the bougie was left in the esophagus for only five to ten minutes, otherwise usually for one-half hour. Sometimes in smaller children, when the saliva cannot be expelled, the bougie had to be removed for a short while, and then had to be reintroduced. Bokay never saw a hemorrhage from the use of the bougie. The bougie was introduced daily for three or four weeks, then only every second day, and after three or four weeks only twice a week, and at last only once a week. In cases in which spasm of the esophagus was present, a papaverin-procain-anesthesin solution was used one-half hour before the treatment. Of the 148 patients 70 per cent. were under 3 years of age. Of these, five were less than 1 year old. As a rule, the patients were cured without formation of a stricture, with the exception of those cases in which the treatment was interrupted on account of the neglect of the parents, or on account of intercurrent diseases. Eighty-seven and eighty-four hundredths per cent. were cured without stricture. In one single case a stricture occurred in spite of early and systematic treatment, but still bougie No. 30 could be passed. Even a short interruption of treatment was harmful. Eight patients died. In only two of these, a perforation was caused by the bougie. Two others showed a rupture of the esophagus after use of the bougie, but there was no direct perforation.

In one patient, several perforations of the stomach were found but these were not in connection with the use of the bougie. One patient died of sepsis caused by the erosion of the oral mucous membrane and another died of pneumonia. In one instance the child died at home; the cause of death could not be determined, as necropsy was not possible. In this case a perforation in consequence of the treatment cannot be excluded. If Bokay assumes a perforation in this case, then three perforations occurred in 148 cases, namely, 2 per cent. If the two cases of indirect rupture of the esophagus were added to the few cases of undoubted perforation, and to the one case of possible direct perforation the percentage was 3.3. These results have been much better than the former sad experiences with stricture of the esophagus. Lotheissen thinks that in adults the power of regeneration of the esophagus is not so great as in children, but Salzer is of the opinion that merely theoretic reasons should not stand in the way, especially because also in adults favorable results have been obtained, although only in a small number of cases. Erdélgi (Szeged) reported thirty-eight cases, of which two-thirds were adults, all of whom were cured. Steinthal (Vienna) in Hohenegg's clinic treated four patients with good results. Kuemmel and Zoege von Manteuffel experienced good results in adults by early treatment. Therefore Bokay agrees with Salzer, when the latter states that it is our duty to employ the bougie early in erosions of the esophagus in children and that in adults there exists at least well founded justification for the same procedure.

NECROSIS OF THE UPPER JAW IN THE NEW-BORN AND NURSLING. M. PAUNZ, Ztschr. f. Hals-, Nasen-u. Ohrenh. **11**:49 (March 14) 1925.

The child suddenly becomes sick with high fever; one cheek is more or less inflamed and swollen; the inflammatory edema extends also to the upper and to the lower lid. Frequently, abscess formation can be demonstrated. Copious thick pus emanates from each nostril, the alveolar region is thickened and one or more suppurative and granulating fistulas can be noticed. The swelling may extend to the hard palate. Abscesses may be found in other parts of the body. Later the upper jaw becomes either partially or totally necrotic. In almost every case a cure results after sequestration of bone, and of some teeth buds. Schmiegelow called septicopyemia acute osteomyelitis of the upper jaw. Bourraqué, Canestro and Schlemmer assumed a primary suppuration of the antrum of Highmore. Hajek considers it to be a primary osteomyelitis of the upper jaw and a secondary suppuration of the antrum of Highmore. Logan Turner assumes the same. Seven cases in point have been observed in the University Children's Clinic in Budapest during the last years. Their ages were from 3 weeks to 3 months. In one case the beginning of the disease was noticed after birth, in the others when the children were 5 days, 8 days, 2 weeks, 6 weeks, 3 and 3½ months old respectively. In each child the face was swollen, and pus discharged from the nostrils. Three cardinal symptoms had been present: 1. Edema and frequently abscess formation in the face and eyelids. 2. Copious discharge from the respective nasal cavity. 3. Periosteal swelling of the alveolar process of the respective upper maxilla with suppurative fistulas in which the probe touched rough bone and necrotic teeth buds. In the majority of cases, it was a local disease with more or less severe symptoms, but in three cases pyemic and septic general symptoms developed. It can be easily imagined, Paunz states, that the maxillary antrum, which has been infected by the nasal route, furnishes the origin of the osteomyelitis. In the cases which came to necropsy the suppuration of the antrum of Highmore, without the infection of the ethmoid cells, could be established without a doubt. The prognosis is favorable in the purely local, doubtful in the pyemic and unfavorable in the septic cases. The treatment is simple. The abscesses are opened, the fistula channels are enlarged and the necrotic bone and teeth buds are removed. Only necrotic pieces of bone and teethbuds which are ready to be cast off must be removed. This necessitates several operations. Paunz describes his seven patients, five of whom were cured.

AMBERG, Detroit.

Society Transactions

THE CHICAGO LARYNGOLOGICAL AND OTOLOGICAL SOCIETY IN JOINT MEETING WITH CHICAGO OPHTHALMOLOGICAL SOCIETY

March 2, 1925

E. P. Norcross, M.D., *Chairman*

Specificity of Spirochetes in Diseases of the Eye, Ear, Nose and Throat.

Presented by Dr. Louise Pearce of the Rockefeller Institute, New York City (by invitation).

The study of experimental syphilis in the rabbit permits of the investigation of numerous problems which have an important bearing on the disease in human beings, since many factors concerned in the experimental infection are known and can, to a greater or a lesser degree, be controlled. Under these circumstances, therefore, an interpretation of the effect or significance of such factors is possible. In syphilis of man, the study of cause and effect is extremely complicated and it is often difficult to arrive at any conclusion as to conditions which favor or which prevent the occurrence of one form of the disease or another.

The conception of specificity, as applied to strains of *S. pallidum*, was founded on clinical observation and has largely centered about syphilis of the central nervous system. From an experimental standpoint, no stronger evidence in support of the conception of "selective affinity" has been submitted than that first advanced by Nichols and Greene and by Reasoner, based on the production of lesions of the eyegrounds. Less attention has been paid to the host or to conditions that exercise their influence through the host, and consequently there has been a strong tendency to attribute clinical variations in the course of the disease to differences in the biologic properties of spirochetes rather than to differences in animal constitution or to the circumstances under which the infection was contracted.

The three factors of foremost importance concerned in determining the course of syphilitic infection are: (1) the causative agent of the disease; (2) the resistance of the host; (3) the circumstances under which the infection occurs. In reality, each factor consists of many elements or subdivisions, all or many of which may play significant rôles in the reaction, and the result of which is seen in the particular example of the disease observed. No fixed value can be assigned to any of these factors. Some of them tend to increase the severity of disease or predispose to the development of certain types of lesions, while others neutralize these effects or tend to reduce all manifestations of disease to a minimum, and it is evident that a given result may be brought about in a variety of ways.

In experimental syphilis of the rabbit, one of the most striking features is the great variation in the disease picture both as regards the primary and the generalized lesions. An example of this is seen in the lesions of the eye. The liability of this organ to involvement is greater than that of most tissues since it is not protected to an equal extent by the general reaction that takes place in other parts of the body. Almost any recently isolated

strain tends to produce a considerable number of eye lesions and apparently some organisms are more prone to the production of lesions of this class than are others. Moreover, there may be distinct differences in the character and severity of the lesions produced by organisms derived from various sources. However, none of these properties appear to be attributable to fixed biologic characteristics, for which continued passage the incidence and severity of eye lesions may increase or diminish and both the character of the lesion and the time of its occurrence may be affected. In addition, with a given strain of organisms, a change in one direction may be followed by a change in the other. The occurrence of such variations suggests that the tendency displayed by certain organisms to the production of particular types of lesions represents an expression of an existing state of balance between the organism and the host rather than an inherent predilection on the part of the organism.

The part played by the host in the evolution of the disease may be studied experimentally in many ways. The factors of sex and certain physicologic states, such as pregnancy, profoundly modify the course of infection. As a rule, the manifestations of disease are less numerous and less pronounced in female rabbits than in males, while pregnancy usually exercises a still greater restraining influence over the incidence and development of syphilitic lesions. Another example of the influence of the host is seen in the different type of disease produced by the well-known Nichols' strain of pallidum, handled in such a way as to favor the host rather than the organism. This has been accomplished by the testicular inoculation of the popliteal lymph nodes of rabbits which had shown no syphilitic lesions for a considerable period of time. Successive generations have been inoculated in this manner during the last five years. Animals inoculated according to this procedure have shown no generalized lesions other than a metastatic orchitis. On the other hand, rabbits inoculated with the same strain intratesticularly at comparatively frequent intervals using emulsions of infected testicle have continued to show an infection characterized by the development of lesions in remote parts of the body, such as the periosteum and bone, the skin and the eyes.

The variation in the disease picture among a group of five or ten rabbits inoculated with a given strain and by a uniform procedure, such as the intratesticular or the intracutaneous route, is a characteristic and striking feature of syphilis of the rabbit. In such a series the proportion of severe, mild and intermediate grades of disease, as determined by the number, severity and duration of lesions, is roughly 1 : 1 : 3. While the general grade or severity of the infection may vary within rather wide limits from time to time, these values are relatively constant for any strain at a given time. The course of the disease, therefore, would seem to be determined to a large extent by the sensitiveness of the animal and the promptness and efficiency of the defensive reaction which are expressions of animal constitution and animal economy. In this connection, it is significant that the character of the disease that one can produce with a given strain of *S. pallidum* changes with the season of the year or from year to year. Thus, during the summer months, the disease is always comparatively mild, while the periods of greatest severity are spring and fall.

The circumstances under which the infection occurs or is initiated are likewise of great importance in determining the course of the infection. An infection produced by spirochetes, the vitality of which is low, will not be the same as one produced by organisms that are highly active. In general, such an infection is initiated slowly with comparatively minor primary lesions, but its general character is often insidious, for it may progress much further than one that assumes more severe proportions during the early stages. In

like manner, infections produced by different routes of inoculation tend to pursue different courses. Thus, the manifestations of disease resulting from an intratesticular as compared with an intracutaneous inoculation, using comparable amounts and strengths of inoculating doses, tend to be more numerous and severe although they may not be more enduring. Again, the disease picture produced by the application of an emulsion rich in spirochetes to the normal mucous membrane of the conjunctival sac or the sheath differs in many respects from that produced by intracutaneous or testicular inoculation. It was found that a simple instillation of a spirochete emulsion into the conjunctival sac or sheath was all that was necessary to obtain an infection. The infection thus produced, however, tends to pursue a mild or asymptomatic course and frequently without the development of a characteristic chancre. It is also possible to modify the character of an infection by various procedures carried out at the time of inoculation or shortly thereafter. Thus, significant differences are observed if one inoculates one or both testicles, or if the inoculated organ is castrated soon after inoculation, or if insufficient treatment is administered early in the course of the disease.

From these experiments, it is apparent that there are many factors in the biology of syphilitic infections which operate in the production of the disease picture. There is a great deal of evidence to show that under a given set of conditions and at a given time in the life history of an organism, the properties possessed by it may increase or decrease the liability to the occurrence of lesions of a given type. However, we are not justified in assuming that there are distinct strains of pallidum capable of producing entirely different types of disease, unless it be clearly understood that such properties may be lost or acquired by any strain and that in any case the action of such organisms is subject to the operation of outside influences which may completely nullify any existing tendency on the part of such organisms.

Lantern slides illustrated various lesions of experimental syphilis in the rabbits and included: (1) Types of primary orchitis and chancres and of generalized lesions, such as those of the bones, periosteum and tendons, the skin and mucous membranes, and the eyes; (2) primary and generalized lesions of individual animals; (3) variations in the character of the disease produced by strains of spirochetes well adapted to the rabbit (high virulence) and by those of recent isolation (low virulence); (4) variations in the disease picture produced by differences in the route of inoculation — testicular, intracutaneous and mucous membranes, and by various procedures such as castration and insufficient treatment instituted at various times after inoculation; (5) variations in the disease of males, females and pregnant females; (6) charts and tables summarizing the significant differences in the disease resulting from various procedures carried out to show that conditions operating through the host can, of themselves, determine the course of the infection and thus bring about striking variations in the character of the lesions which, if the circumstances of the experiment were not known, might be interpreted as due to specificity of the particular organism used.

DISCUSSION

Dr. D. J. Davis, Head of the Department of Bacteriology and Pathology, University of Illinois (by invitation), said that Dr. Pearce's study represented very well the proper relationship which should exist between laboratory and animal experimentation and the study of diseases that exist in the human being. Progress in this field, if analyzed, could be seen to be dependent very largely

on the proper coordination between these two fields of work. So often the one supplements the other. He believed that this mode of study of disease should be applied particularly to those diseases of a chronic character in which the solution is often difficult.

The number of spirochetes that are of interest to medicine is multiplying very rapidly. Dr. Davis has done little experimental work with syphilis but has been interested in other members of the group of spirochetes; he thought it might be interesting to present certain work done on spirochetes with special reference to putrid and gangrenous infections. Certain spirochetes are often associated with fusiform bacilli and a pyogenic coccus in their disease activities. These organisms furnish an excellent example of how bacteria may cooperate, in this way causing serious infection. Any one of these organisms operating alone would do little or no harm.

The fusiform bacillus is an anaerobic organism, stains very readily, grows easily in animal tissues, as stated, and frequently cooperates with the spirochetes. The fusiform bacillus and the spirochetes together belong to a group which is frequently referred to as opportunists. By this term is meant that they do no harm ordinarily until proper conditions arise furnishing them with an opportunity to exercise their potential pathogenic powers. In dealing with these opportunists, the location of the infection is determined very largely by the normal distribution of these organisms. This is a very important rule or principle which has not been sufficiently emphasized. For example, most staphylococcus infections occur in the skin or near the skin because the normal habitat of this organism is in this structure. Likewise, streptococcus infections chiefly occur about the throat, because these organisms normally occur there, and this same principle applies in connection with the activities of other micro-organisms.

From their studies of the fusospirochete group, they have found that these organisms normally occur chiefly in four localities about the body. First, in the crypts of the tonsils in which these organisms occur either diffusely, growing on the crypt mucosa, or in well-defined ray-like granules known often as actinomyces-like granules. The latter have nothing whatever to do with actinomycosis but are masses of organisms chiefly composed of fusiform bacilli, spirochetes, and cocci together with leptothrix threads. They are very commonly found in nearly all individuals at times. Second, the teeth, where these bacteria tend to grow around the tooth just at the gingival margin. They appear in granular forms somewhat similar to the granules in the tonsil crypts. Third, they are found in certain parts of the gastro-intestinal canal, especially in the region of the appendix, and fourth, they appear about the genitalia in both male and female, especially in smegma deposits. They may occur occasionally in other localities. (Dr. Davis presented a series of lantern slides demonstrating these organisms and various lesions resulting from their activities.)

It is interesting that the lesions caused by the activity of these organisms frequently occur in the region of the mouth and especially in the upper respiratory passages. For example, in alveolar abscesses one very often finds in addition to streptococci, fusiform bacilli and Vincent's spirochetes. If anaerobic cultures and smear preparations are carefully made, these organisms can be found often in many but not in all such lesions. It should be pointed out, too, that a characteristic odor so often noted is caused by these two organisms and not by the streptococcus. In putrid sinus infections and also in putrid otitis media, these organisms invade secondarily these localities and modify essentially the character of the lesion. Very often, too, these organisms pass down from the teeth and the tonsils into the lungs. Here, if conditions are

suitable, a putrid type of bronchitis or pneumonia may ensue. It is this type of pneumonia that is particularly apt to follow tonsillectomy, extraction of teeth, anesthesia and the like. Dr. Pilot, working with Dr. Davis has studied many cases of gangrenous and putrid bronchopneumonia, nearly all of which are complicated with this type of infection. In such lungs these organisms appear often in enormous numbers, the spirochetes occurring in large tangled masses, and the fusiform bacilli occurring in large numbers together with pyogenic cocci, usually the streptococcus. In tuberculous lungs, invasion by fusospirochete organisms is rare. It occasionally occurs, however, and then the sputum becomes very putrid and contains many of these organisms; the lung tissue then tends to dissolve and become gangrenous, usually in localized areas. Occasionally, the organisms evidently pass into the blood stream, for as a complication of these lung infections putrid abscesses of the brain are prone to occur. These may be single or multiple. Rarely do they metastasize to other parts of the body. Fusospirochete organisms, usually with streptococci, very often occur normally about the genitals, especially in the smegma; here, when conditions are suitable, especially in persons with a long prepuce, these organisms may develop rapidly and cause an erosive, at times a gangrenous, balanitis. The process may rapidly extend, involving the genital organs.

Experimentally, they have found that the rabbit is quite easily infected with the fusospirochetes-pyogen combination. When injected intrapleurally, putrid, extensive empyema rapidly develops which may kill the animal in from seven to ten days. If the dosage is small, the process may heal, the spirochetes apparently disappearing first. If death ensues, it is usually due to a generalized streptococcus septicemia, the streptococci being found in the heart's blood and in the other large cavities. This indicates that the pyogenic bacteria in these processes are the most virulent and most aggressive, the fusospirochete organisms usually remaining behind and modifying essentially the character of the local primary lesion.

Dr. Pearce (in closing), said that they always welcomed an opportunity to attend clinical meetings and occasionally to speak at them. They feel that while the laboratory workers are doing their best to contribute to this subject, they have often been outdone by the clinician, and that when they attend such meetings they frequently learn more than they give.

COLLEGE OF PHYSICIANS, PHILADELPHIA, SECTION ON OTOLOGY AND LARYNGOLOGY

March 18, 1925

Fielding O. Lewis, M.D., *Chairman*

The Practical Value of the Roentgen Ray in Sinus and Mastoid Conditions. Presented by Dr. Fredrick M. Law (by invitation).

By personal contact between the roentgenologist and rhinologist or aurist, much more can be learned from roentgen-ray studies of the sinuses than if a less intimate relation exists. By verbal consultation, the surgeon can make the symptomatology clear in a manner that a written report cannot duplicate. To the interpreter of the roentgen-ray films this information is of extreme value, and only after possessing this knowledge can he properly estimate his findings. Technically perfect films are absolutely essential.

A proper reading of such films takes into consideration two main factors: (1) anatomy, and (2) pathology. Of these, the former is the more important; more important because the pathology usually is fairly well understood before films are made, but by an accurate description of anatomic conditions the surgeon will be aided greatly in his operative maneuvers. For example, no report of the frontal sinuses is complete unless the observer has stated the size, outline, wall thickness and anteroposterior diameter of the floor of these spaces; no ethmoid report is of real value if it fails to give the position of the capsule border, the relation of the posterior cells with respect to the sphenoid, or the absence of such cells. In considering the antrum of Highmore, the relation of the teeth to this cavity, its size, floor level, wall condition and presence or absence of osseous septums should all be mentioned. The same detailed consideration should be given the sphenoid. Mention of the thickness of the cribiform plate is often of value and help to the surgeon. In short, all anatomic points that could possibly influence or make surgical procedures more accurate should be stressed.

From the pathologic standpoint the roentgen ray does not reveal much not already known, but it helps both to confirm this knowledge and accurately localize the lesion. A film properly made will demonstrate the periosteum and the presence or absence of bony septums; such plates give definite information regarding the acuteness or chronicity of the condition. Chronic purulent sinusitis, for example, shows a demonstrable osteitis of the bony walls; on the other hand, the hyperplastic type gives evidence of an edematous periosteum. Acute conditions cause a lack of definition of the sinus walls while chronic conditions intensify this particular feature. Quite often an anteroposterior view of the ethmoid cells shows nothing abnormal, but an anterolateral exposure of the same patient, however, may show definite evidence of disease manifested by septal absence demonstrable only by such a view. This position, too, gives information of the relation of the posterior ethmoid cells to the sphenoid sinus which is of much value in surgery of that region. In chronic polypoid conditions a peculiar opalescent, milky, gelatinous and glassy appearance is diagnostic.

In the consideration of the mastoid process, its air spaces and roentgen-ray appearance, it is well to know that trivial conditions, such as a furuncle of the auditory canal, may alter its roentgenographic characteristics. Stereoscopic mastoid films should always be made. Only by such examination can the solution of cell walls in the deeper portion of the cavity be diagnosed if the cortical cells are intact. This is often the case in early mastoiditis as examination of this sort has some prognostic value. If large cells are found in the vicinity of the mastoid antrum, operation can be longer deferred than if these cells are very small; in the latter case, when mastoid symptoms are definite, it is safest to operate without delay.

In chronic mastoid conditions the information derived from roentgen-ray studies is of less value. Cholesteatoma as a rule can be diagnosed. Whether a sclerotic or pneumatic process is present can be determined. Often, in post-operative cases that do not subside following operation, an isolated nondraining cell can be demonstrated.

DISCUSSION

Dr. H. K. Pancost agreed with Dr. Law regarding the value and necessity of verbal conferences between the clinician and roentgenologist. It is important that the position of the outlying ethmoid cells should be accurately determined.

Dr. W. F. Manges considered it difficult for most roentgenologists to secure the amount of information from sinus films that Dr. Law is capable of obtaining. In many neurologic patients a roentgen-ray exposure of the entire head is required; frequently these plates reveal unsuspected sinus or mastoid abnormality.

Dr. G. E. Pfahler said that he considered the experience of Dr. Law in sinus and mastoid work to be greater than that of any other roentgenologist and consequently regarded him as an authority. He, too, advanced a plea for perfect films. Great care must be exercised in such photography in order to secure cell wall definition; without this perfection, a proper reading is impossible. He raised the question of radium and roentgen-ray therapy of polypoid conditions and asked Dr. Law his experience in such treatment.

Dr. Law replied that radium has been used in this condition at the Manhattan Hospital but that the results have not been satisfactory. In his opinion, early surgery gives a better chance for cure.

Dr. MacEwen Smith emphasized the necessity of a careful technical interpretation of roentgen-ray findings of the sinus and mastoid regions. It was his feeling that many rhinologists and aurists have little confidence in roentgen-ray findings because their films have not been interpreted with sufficient detailed accuracy. The position of the sigmoid sinus and emissary vein of the mastoid should always be stated.

Dr. C. E. Eves asked Dr. Law if a diagnosis of hemorrhagic mastoiditis can be made when cell wall solution does not occur. In this condition sinus thrombosis often follows with little or no cellular destruction.

Dr. Law said that he considers this type of mastoiditis the most difficult and unsatisfactory type for diagnosis; it occurs most often in large, fairly well developed mastoids. There is a peculiar transparency resembling polypoid conditions; the cell septums are thinner than normal but are not lost, and in the stereoscopic view deep in the region of the sinus plate they may be absent. If mastoid symptoms are definite and the roentgen ray shows slight osseous destruction, be suspicious of this type of mastoiditis. It is well to irradiate on successive days, as bone destruction frequently takes place rapidly.

Dr. George Wood raised the question as to the nature of the sinus shadow in health and disease.

Dr. Law said that as disease of the mastoid process progresses, the sinus shadow becomes more definite, because it is more opaque than the other structures; if, however, softening of the sinus plate has occurred, its outline becomes less distinct. By stereoscopic views, it is usually possible to estimate the depth of this sinus.

April 15, 1925

Studies in the Riverbank Laboratory on the Acuity of Hearing for Air and Bone Transmitted Sound. Presented by Dr. A. G. Pohlman (by invitation).

In the audiometric method of functional hearing tests, we have an accurate gage of the amount of sound used. Although much knowledge can be gained by the use of this instrument, there are many things not yet fully understood. For example:

1. Fields plotted by a curve representing the minimum intensity required to hear various pitches are not necessarily indexes of the subject's auditory power.

2. The relation between air and bone conduction curves is not constant for different persons.

3. The variability of bone transmitted sound is much greater than that of air.

4. Lateralization tests may vary greatly with the person, intensity and pitch.

In his work on lateralization tests, Dr. Pohlman has found that some individuals lateralize to the affected side. If the intensity is increased, however, lateralization ceases. Others show results exactly the reverse, in failure to lateralize for the minimal stimulus with lateralization following an increase of intensity. In the opinion of Dr. Pohlman, the audiometer at present is a research instrument and not applicable for routine otologic testing.

EPHEDRIN, A NEW DRUG; ITS ACTION ON THE NASAL MUCOSA. Presented by DR. GEORGE FETTEROLF and DR. M. B. SPONSLER.

Ephedrin is new only in the sense that it is being used in this country for the first time. Some 5,100 years ago, the Chinese Emperor, Shen Mung, classified the crude drug Ma Huang from which Nagai in 1887 isolated the active principle, an alkaloid, ephedrin.

The Department of Pharmacology of the University of Pennsylvania, in conducting experiments to determine the physiologic action of this alkaloid, has found that on dogs, cats and rabbits it uniformly affects circulation, smooth muscle and secretions, in a manner qualitatively similar to epinephrin. Dr. T. Grier Miller and Dr. Carl Schmidt were instrumental in securing enough of the drug for Dr. Fetterolf and Dr. Sponsler to test its action in solution on the human nasal mucosa.

A group of seventeen patients from the wards of the University Hospital were studied. All possessed a certain amount of turgescence of the nasal mucosa. None had nasal discharge, atrophy or other abnormality.

The color and contour of the nasal mucosa, especially of the inferior turbinates, were first noted and recorded. At the same time the distance from the surface of the turbinate to the septum was measured. Later, a 5 per cent. solution of ephedrin sulphate was applied to the anterior end of the lower turbinate of one side. The patients were examined frequently during the first ten minutes, then hourly for six successive hours, and finally at the end of twenty-four hours.

In each case the mucosa of the turbinate began to shrink soon after application, the maximum shrinkage occurring in an average time of two and one-third minutes. This contraction was not confined to the site of application, but gave general shrinkage of the mucosa throughout the turbinate's entire length. So extreme was this contraction that the outline of the turbinate bone itself was plainly seen. A marked increase of the interval between the septum and the turbinate was observed in all cases. The color of the mucosa invariably became paler, but never showed the extreme pallor which usually follows the application of epinephrin solutions. The first noticeable relaxation of the mucosa took place in two hours and thirty-five minutes. Complete relaxation was observed in three hours and seventeen minutes. No signs of irritation following the application of this solution were seen. The investigators feel that the drug is one of great promise for intranasal use, as it apparently possesses all the virtues of epinephrin and lacks its undesirable sequelae.

CERVICAL ADENITIS. Presented by DR. DRURY HINTON (by invitation).

Dr. Hinton emphasized the necessity for careful diagnosis of cervical glandular enlargements. For this purpose an accurate knowledge of the lymphatic distribution of the head and neck is essential. These anatomic points were clearly demonstrated. The most frequent causes of cervical adenitis are: (1) Trauma followed by infection; (2) skin diseases including parasitic varieties; (3) colds; (4) disease of the tonsil; (5) dental caries; (6) otitis; (7) syphilis, and (8) tuberculosis. An analysis of the cases occurring in the University of Pennsylvania Hospital during the last twenty-five years showed dental conditions and tonsil and adenoid infection to be the foci most often causing glandular enlargements in the neck. Many glandular enlargements formerly diagnosed as tuberculous are today being regarded as chronic inflammatory enlargements of nonspecific origin.

DISCUSSION

DR. GEORGE B. WOOD stated that the nomenclature of the cervical lymphatic nodes is confusing and is not uniform. It is his feeling that the relation of the cervical lymphatics to the mediastinum is not fully understood. In his opinion there are no direct connections. In experimental pigs, he has never been able to produce involvement of the pulmonary nodes by cervical lymphatic extension.

A UNIQUE CASE OF FRONTAL SINUSITIS. Presented by DR. GEORGE B. WOOD.

Dr. Wood presented the case of a man, who developed edema of the left upper lid, localized pain and mild constitutional symptoms following a cold in the head. These symptoms disappeared after a short period of rest in bed only to recur in a more aggravated manner a short time after getting out of bed. Again rest caused the condition to subside but recurrence followed his return to normal activities. This time subdermal crepitus was palpable in the left frontal region. The roentgenogram showed the left frontal sinus to be clearer than the right, but the edges on the left side lacked definition. Serologic tests were negative.

At operation it was found that bone necrosis of both the anterior and posterior walls of the frontal sinus on the left had occurred. There was extensive dural exposure. The septum between the right and left sinuses was broken down, allowing the right side to become filled with pus and granulation tissue. At the time of the first operation external drainage only was performed; later an opening into the nose with closure of the external wound was performed. The external wound closed by primary intention, with the exception of a small, persistent sinus in the lower portion. The nasal septum, which was markedly deviated to the left, will be corrected at a subsequent operation.

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